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GLACIERS OF PRINCE WILLIAM SOUND AND THE SOUTHERN PART OF THE KENAI PENINSULA, ALASKA

III.—GLACIERS OF THE WEST COAST OF PRINCE WILLIAM SOUND*

BY

U. S. GRANT AND D. F. HIGGINS

The western shore of Prince William Sound south of Passage Canal is away from the usual routes of travel, and has been little visited even by prospectors. As a result the details of the shore line have not been well shown on recent maps, most of which have evidently relied on the information furnished by the older Russian charts. The glaciers also have not been studied until very recently, and they have been shown in a generalized manner or omitted entirely from the maps. In 1887, Captain S. Applegate explored and first mapped the upper part of Port Nellie Juan†, and in 1905, 1908 and 1909 the writers made a reconnaissance of the west shore of Prince William Sound for the United States Geological Survey. The results of the mapping of 1887, 1905, 1908 and 1909 have been in-

* Published with the permission of the Director of the United States Geological Survey.

Earlier articles in this series appeared in the *Bulletin*, vol. 42, 1910, pp. 721-738, and vol. 43, 1911, pp. 321-338. A general map of Prince William Sound, showing the location of the various fiords and bays noted below, accompanies the first of these articles, and another map, showing in more detail the northwestern part of the Sound, accompanies the second article.

† Quoted by George Davidson. The glaciers of Alaska that are shown on Russian charts or mentioned in older narratives. *Trans. and Proc.* Geogr. Soc. of the Pacific, series 2, vol. 3, 1904, pp. 1-98.

corporated in two recently published small scale maps.* The glaciers of this area have not, as far as our knowledge goes, been figured or described before, but some of them have been mentioned briefly.

PASSAGE CANAL

There are no glaciers which reach tide water on Passage Canal, although several approach the canal from the north, west, and south-

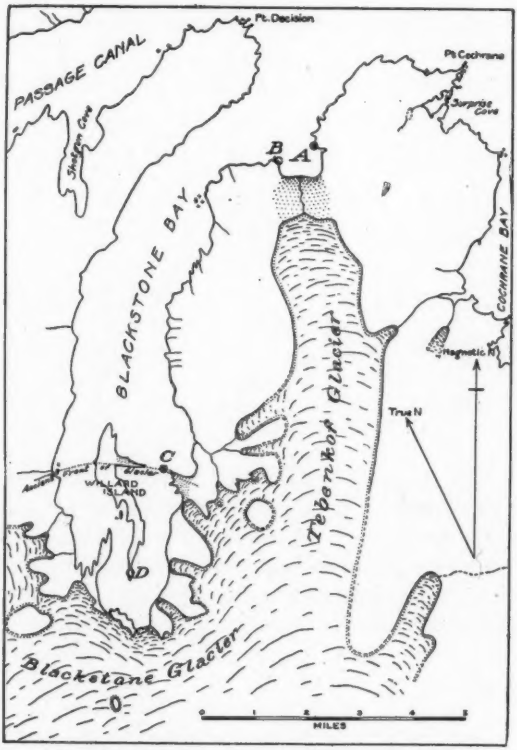

FIG. 1—Map of Blackstone Bay, July 5, 1909. Photographs of the glaciers were taken from points marked A, B, C, and D.

west. The Seth and Billings glaciers descend southward from the same general ice field which feeds the Harriman Glacier and end within about a mile of the north shore of Passage Canal. Northwest of the upper part of the Canal are at least three smaller glaciers

* U. S. Coast and Geodetic Survey, Chart No. 8550, 1909. U. S. Geological Survey, *Bull.* 442. pl. 2, 1910.

draining into this body of water.* The most important ice stream near the Canal is the Portage Glacier, described below.

Portage Glacier

A hasty visit was made by our party to the head of Passage Canal (Portage Bay) on July 3, 1909. The eastern terminus of Portage Glacier was too far distant from the shore and too much hidden by a low bare rocky point in the gravel-filled valley to permit of any careful observations. It is probable that no large part of the glacier debouches on the east side of the divide between Passage

Fig. 2—One of the eastern ice lobes of the Blackstone Glacier from Point C of Fig. 1, July 5, 1909.

Canal and Turnagain Arm, for no large glacial stream enters the head of the Canal. A trail over this glacier was much used as a route from Prince William Sound to Cook Inlet till the Seward-Sunrise trail was opened. In 1898 Mendenhall visited the head of Passage Canal and crossed the portage to Cook Inlet. His description of this portage and the glacier† is of much interest, and the following paragraph is from his report:

* The *Bulletin*, vol. 43, 1911, p. 322, fig. 1.

† Mendenhall, W. C., A reconnaissance from Resurrection Bay to the Tanana River, Alaska, in 1898. *Twentieth Ann. Rep.* U. S. Geol. Survey, pt. 7, 1900, pp. 273, 325-326.

"The isthmus which connects Kenai Peninsula with the mainland is only about 12 or 13 miles broad from tide water to tide water, and probably stands but little above sea-level; but for 5 miles of this distance it is buried under a glacier which flows from the high mountains of the peninsula to the south. This glacier at its highest point is about 1,000 feet above tide, and can be crossed in a few hours from the open waters of Portage Bay by prospectors or others who desire to reach Sunrise City or the headwaters of Cook Inlet before this body of water is open to navigation in the spring. For more than a hundred years it has been used as a route, first, by the Russian and Indian traders, and later by miners, who usually cross it without difficulty in the winter or early spring. In the summer the crevasses open, and it is but rarely used, especially since at that

FIG. 3—Western tide-water part of front of Blackstone Glacier from Point D of Fig. 1, July 5, 1909.

season the all-water route is so much easier and cheaper. On the morning of our first trip across the portage a light rain was falling at the foot of the glacier, but before we reached its highest point we found ourselves enveloped in a blinding blizzard, which obliterated the well-beaten trail and hid completely from our view all landmarks which might serve to guide us. Fortunately the storm was at our backs, and helped rather than retarded our progress but even then, had it not been for bushes which earlier travelers over the same route had stuck in the snow to mark the trail under just such conditions, we should have been hopelessly lost."

BLACKSTONE BAY

The early maps of the shore line between Point Culross and Passage Canal were inaccurate, probably due to the fact that none

of the explorers making these maps followed closely the intricacies of the shore line. Blackstone Bay was fairly well shown except for its head, but Cochrane Bay was poorly delineated, and Culross Passage was not shown at all. Vancouver's map (1794) of this district and Tebenkof's (1849) have formed the basis for other and later maps. Applegate's map of 1887 adds some detail, and is the first map we have access to which indicates the Tebenkof Glacier. The passage (Culross) behind Point Culross was reported by the U. S. Geological Survey reconnaissance of 1905 and indicated on Chart No. 8502 of the U. S. Coast and Geodetic Survey in 1907.

On the maps of Vancouver and Tebenkof "ice and snow," which undoubtedly refers to a glacier discharging into the sea, are shown

FIG. 4—Central tide-water part of Blackstone Glacier from Point D of Fig. 1, July 5, 1909.

at the head of Cochrane Bay and the description* indicates the same fact. There is evidently a mistake in locating this glacier,—it should be at the head of the next bay to the west (Blackstone Bay),—for there is no evidence that in historic time a glacier occupied the head of Cochrane Bay. The land at the head of this bay is comparatively low, and this low land extends south-southwest to Port Nellie Juan. The glacier seen by Vancouver was evidently the Blackstone Glacier which reaches the tide water at the head of Blackstone Bay.

Our information concerning the glaciers of Blackstone Bay was gained by a hurried reconnaissance on July 5, 1909. No information concerning the definite positions of the fronts of these glaciers at an earlier date is extant.

* Davidson, George. The glaciers of Alaska that are shown on Russian charts or mentioned in older narratives. *Trans. and Proc.* Geog. Soc. of the Pacific, series 2, vol. 3, 1904, p. 23.

Tebenkof Glacier

The front of the Tebenkof Glacier comes within about a mile and a quarter of the shore of a small bay on the south side of the entrance to Blackstone Bay, and is named after Capt. M. D. Tebenkof, Governor of Russian America from 1845 to 1850. This

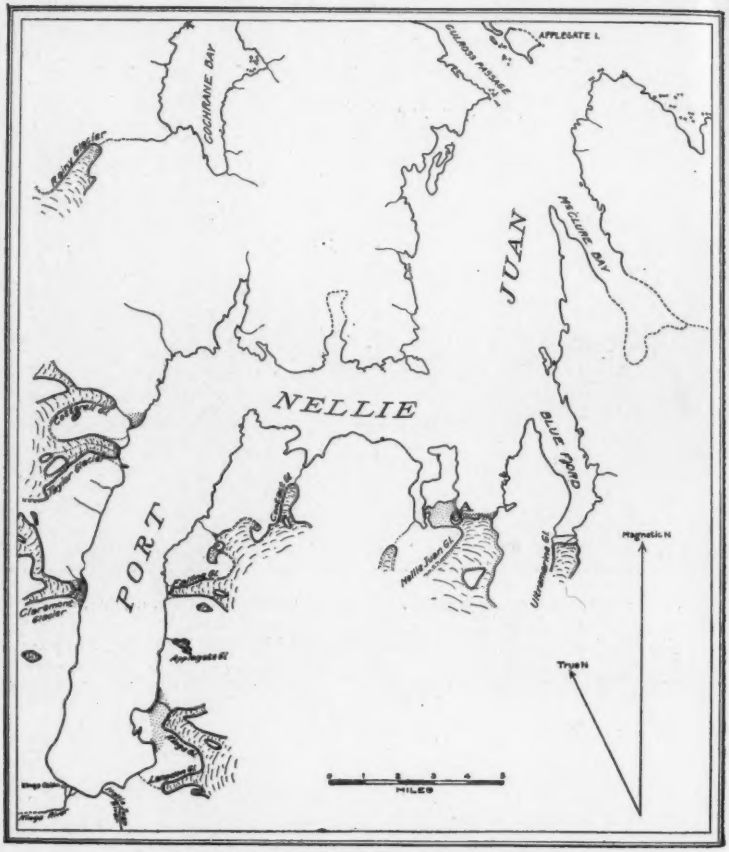

Fig. 5—Map of Port Nellie Juan, August 8 and 9, 1908.

glacier is an ice stream of from a mile and a half to two miles in width which flows northward in a valley parallel to Blackstone Bay. The ice field of this glacier is continuous with that of the Blackstone Glacier (Fig. 1). The Tebenkof Glacier has a comparatively low slope and its front lies on a flat of glacial débris. This flat has in

places a forest which would indicate that the glacier had not reached tide water in the last century, and probably not in a considerably longer period. On both sides of the front of the glacier there is a bare zone, estimated at 500 feet in width, which has apparently recently been covered by ice. The date of this advance, which probably destroyed part of the forest at the west edge of the glacier, is uncertain, but from the lack of vegetation on the bare zone it is thought that this advance took place within the last 10 or 15 years. The front of the glacier was not visited, and so nothing is known of the actual distance between the present front of the glacier and this recent advanced position, which marks the point of maximum advance since the growth of the present forest.

FIG. 6—Front of Nellie Juan Glacier from Point A of Fig. 5, August 8, 1908.

BLACKSTONE GLACIER

The Blackstone glacier surrounds the head of Blackstone Bay, sending down from a very extensive ice field no less than ten ice streams (Fig. 1). Two of these streams have discharging cliffs at sea-level and two others on the east side of the bay reach just to high tide on gravel aprons formed at the lower ends of the alpine valleys occupied by the glaciers. The earlier maps show the south end of Willard Island covered by ice, but as this seeming condition is very deceptive till one comes almost to the south end of the island,

and as the size and density of the vegetation on the island indicate a number of decades' growth, it is altogether probable that the ice has not been as far forward (north) as Willard Island within the time of which we have record, *i. e.* since 1794.

There is very good evidence, however, that at an earlier date, perhaps two centuries ago, the front of the Blackstone Glacier did extend well up to the north end of Willard Island. In figure 1 is shown the approximate position of this ancient ice front. North of the line indicated the island is heavily forested, but south of it by an abrupt change there are but sparse fir trees, though a dense growth of shrubbery has sprung up. On the west side of the island a small

FIG. 7—Bare zone recently occupied by ice, small moraine, and forest (at the right) untouched by the last recorded advance of the Nellie Juan Glacier, August 8, 1908. The small summit to the right of the center of the photograph is Point A of Fig. 5.

gravel point marks the old terminal moraine. No precise location of the old front could be determined on the west side of the bay. On the east side of both island and bay is a very notable accumulation of morainal material extending out from the island and the mainland, joining under a shallow channel where tidal currents run very swiftly. The two points south of Point C in figure 1 may be modified remains of two recessional moraines. Although the island itself is very sparsely timbered south of the old ice front the gravel deposits on the east side of the bay are heavily timbered (Fig. 2). The development of sparse and dense forests in approximately the same

time is doubtless due to the more favorable conditions for forestation upon the gravel than on the bare glaciated rock of the island.

The photographs here reproduced as figures 3 and 4 were taken from the south end of Willard Island. They show the two discharging portions of the glacier. The scenery from this point is nearly as wild and desolate as that at the head of Harriman Fiord. From the west through the south to the east one views a vast ice field almost barren of nunataks stretching back to a brilliant white skyline. From the central mass deploys tongue after tongue of ice which either laps down over smooth rock slopes or breaks into the sea. It requires but little effort of the imagination to picture all these streams

FIG. 8—Detail of the small moraine shown in Fig. 7, August 8, 1908. Fragments of trees overwhelmed by the ice may be seen in the moraine. The trees at the right were not injured by the ice which built the moraine.

coalesced into one giant ice-stream filling the whole head of the bay and extending far down over Willard Island to the ancient moraine.

PORT NELLIE JUAN

Port Nellie Juan (Fig. 5), sometimes called Kings Bay after a prospector who had a cabin near its head, is the most extensive embayment on the west coast of Prince William Sound. We visited this port on August 8 and 9, 1908, but did not examine in detail the glaciers on its west side.

South of the central part, and east of the southern part of Port

Nellie Juan is a snowfield of unknown but considerable extent. Several glaciers flow north and west from this field, and two of them, the Nellie Juan and the Falling glaciers, reach tide water. On the west side of the southern part of the port are other glaciers, one of

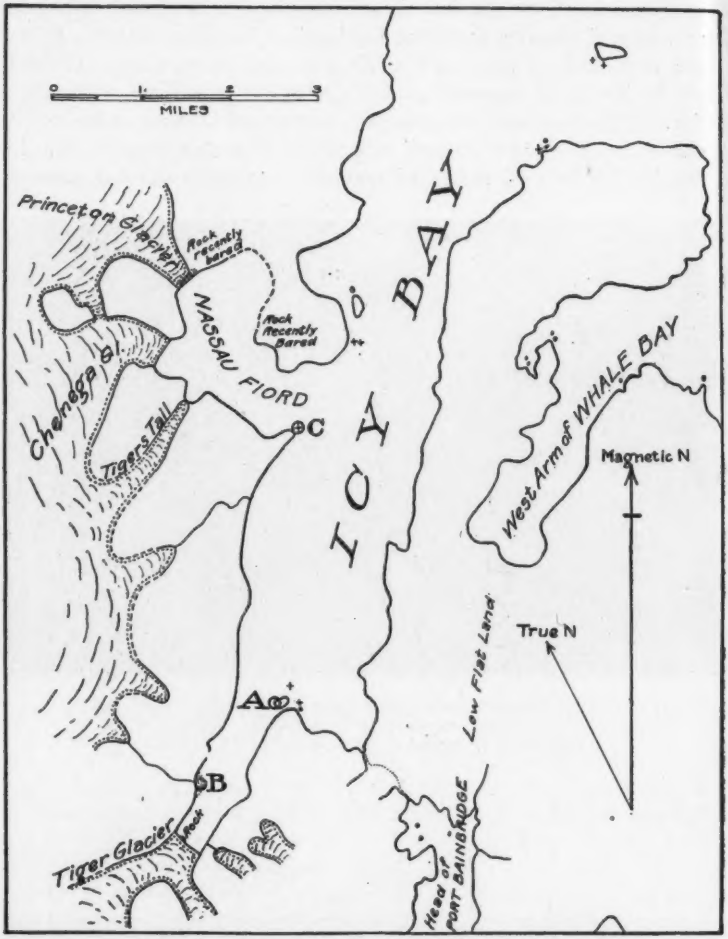

FIG. 9—Map of Icy Bay, August 5, 1908. Photographs of the glaciers were taken from Points A, B, and C.

which, the Taylor, reaches sea-level. The head of Port Nellie Juan is shallow and the waters very muddy. This is due to streams from the adjoining glaciers, and especially to the fact that the two large

streams, Kings and Nellie Juan rivers, entering the head of the port, are charged with glacial silt. These streams come from one of the largest ice covered areas of the Kenai Peninsula.

Ultramarine Glacier

The Ultramarine Glacier, so named because of the clear blue color of the ice near its end, is situated at the head of Blue Fiord, the second (from the entrance) deep indentation in the southeastern coast of Port Nellie Juan. The glacier comes within about a quarter of a mile of tide water and the western part of the front extends farther forward than the eastern two-thirds and rests on a glacial

Fig. 10—Chenega and Princeton (on the right) Glaciers from Point C of Fig. 9, August 5, 1908.

flat. The eastern part of the front rests on a rock ridge about 300 feet above the sea. On this ridge there is a marked bare zone, and also one on the side of the glacier. The front of the glacier was not visited, but at a distance this bare zone appeared as if the ice had retreated from it in the last two or three years. Applegate's map indicates that the glacier in 1887 reached to tide water along its whole front. The forest in front of the eastern part of the glacier shows that this could not have been the case, although the western part may have reached tide water at that time, but even this is doubtful. Our observations on this glacier were made at a distance of about a mile and a half.

Nellie Juan Glacier

The Nellie Juan Glacier (Figs 5 and 6) is the largest, at least in breadth of front, on Port Nellie Juan and is named after this port. The front of the glacier is distinctly in view from the entrance to the port, and rests on a gravel beach, most of which is covered by high tide; and near the center of the front the ice is bathed by low tide water. On both sides of the lower part of the glacier is a distinct bare zone of smoothed granite, and this bare zone, which is 100 to 500 feet in width, ends abruptly at the edge of a forest covered tract. This zone is prominently developed on a granite knob, almost

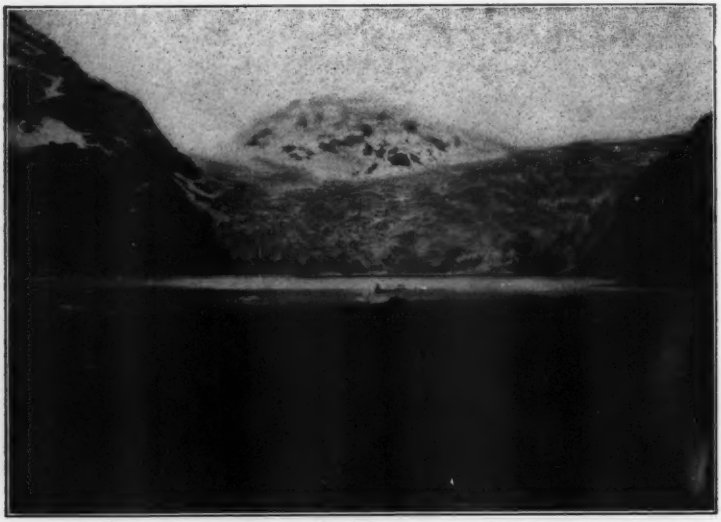

Fig. 11—Tiger Glacier from Point B of Fig. 9, August 5, 1908.

an island, at the west side of the glacial front. Crossing the top of this knob is a small moraine (at Point A on Fig. 5) from 1 to 10 feet in height and 5 to 30 feet in width. This moraine contains decaying fragments of trees, and just to the north of it is an area of scattering trees, some of which are a foot in diameter (see Figs. 7 and 8). To the south of the moraine is some vegetation,—moss, grass, alders 5 feet high, and a few spruce trees 4 feet high. Most of the vegetation disappears half way from the moraine to the ice front. From the extreme summit (Point A, Fig. 5) of the above granite knob the nearest point of the moraine is 48 feet distant in a direction

S. 10° W. From the same summit the extreme front of the glacier is 500 feet distant in a direction S. 13° W.

The moraine noted above marks the farthest advance of the ice since the growth of the present forest, *i. e.*, for a century, and most

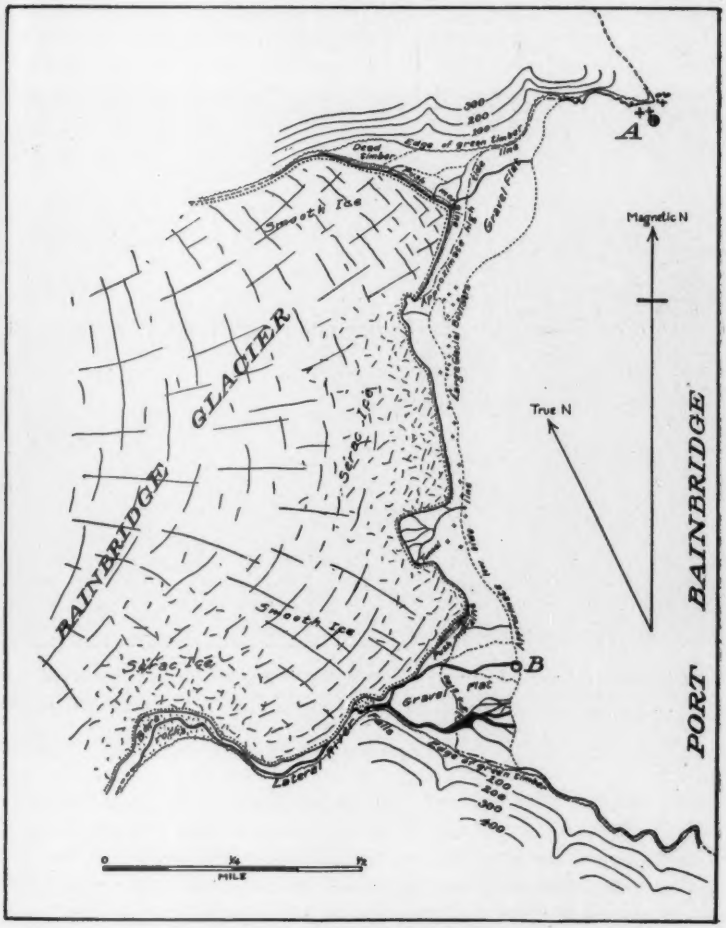

FIG. 12—Map of the front of the Bainbridge Glacier, August 3, 1908.

probably for a few centuries. The date of this maximum historical advance is, at a minimum, twenty years, and probably the actual date is considerably longer ago than twenty years.

ICY BAY

No glaciers exist near tide water in Prince William Sound between Port Nellie Juan and Icy Bay (Fig. 9), which is a fiord in the southwestern part of Prince William Sound. Its axis runs northeast and southwest and the fiord is approximately 10 miles in length. This bay has been represented on the maps as about 4 miles in length with an east and west axis. It was not until after the United States Geological Survey reconnaissance of 1908 that the bay was delineated with approximate accuracy.* The reason for this lies in the fact that the later maps followed Vancouver's representation of this bay,

FIG. 13—Front of Bainbridge Glacier from Point A of Fig. 12, August 3, 1908. Point A is the top of the most southerly reef at the north side of the entrance to the shallow bay in which is the Bainbridge Glacier; this reef is covered by ordinary high tide.

and he reported† that the bay was "terminated by a compact body of ice that descended from high perpendicular cliffs to the water side." At that date (1794) it is very probable that the glaciers in Nassau Fiord, the large bay on the northwest side of Icy Bay, completely filled that fiord and extended out into, but not across, the main part of Icy Bay. This, together with the extensive discharge of ice from these glaciers (combined as one), probably prevented close inspection of the bay and the discovery of its upper part.

* Grant, U. S., and Higgins, D. F. Copper mining and prospecting on Prince William Sound. *Bull.* U. S. Geol. Survey No. 379, 1909, pl. 4.

† Quoted by Davidson, George, op. cit., pp. 23.

Our visit to Icy Bay was on Aug. 5, 1908, when we made a hasty reconnaissance of the bay, came within half a mile of the Tiger Glacier and obtained our information concerning the Chenega and Princeton glaciers from the rock islet (Point C on Fig. 9) at the entrance to Nassau Fiord. The following year Icy Bay was visited by the George W. Perkins' party, and the names here used are those proposed by that party with the exception of the name Chenega Gla-

FIG. 14—Extreme north side of front of Bainbridge Glacier showing moraine, overturned trees, and forest partly killed by outwash gravels. August 3, 1908.

cier and the use of the name Princeton for the glacier immediately northeast of the Chenega. The Chenega is the main discharging glacier in Icy Bay and has long been known locally by that name.

CHENEGA AND PRINCETON GLACIERS

The Chenega and Princeton glaciers reach tide water at the head of Nassau Fiord (Fig. 9). The former glacier is discharging

abundantly and furnishes most of the floating ice so common in, and about the mouth of Icy Bay. From the top of a small rock island at the entrance to Nassau Fiord (Point C of Fig. 9) a good view may be had of both the Chenega and Princeton glaciers (Fig. 10); the extreme southern edge of the front of the former is not visible from this point. The rock surface about the entrance to Nassau Fiord has been recently glaciated and no forest has developed on it. It is undoubtedly true that the entrance to this fiord, as well as the peninsula at the north side of the entrance, were covered by ice within the last 100 years, and quite possibly within a much shorter period. The Indians living at the settlement of Chenega have a tradition that the Chenega Glacier reached to the mouth of Icy Bay about 100

FIG. 15—Southern part of front of Bainbridge Glacier from Point B of Fig. 12, August 3, 1908.

years ago. But the growth of the forest about the bay and even well up past the mouth of Nassau Fiord precludes this idea. The tradition more reasonably would refer to the mouth of the northern arm (Nassau Fiord) rather than to Icy Bay itself.

TIGER GLACIER

The Tiger Glacier reaches tide water at the extreme head of Icy Bay. The front of the glacier is steep and its eastern side was discharging in 1908 with fair rapidity. The western half of the front shows a ledge of rock just emerging from under the ice (Fig. 11). Evidently an advance will cover up this ledge and a retreat will make it more prominent.

BAINBRIDGE GLACIER

The Bainbridge Glacier is the only tide water glacier on the port of that name. A mile north of this glacier is a smaller one ending about 500 feet above sea-level. The Bainbridge Glacier does not appear on the earlier maps, although it is in view from ships passing Point Elrington. The first map known to us which shows this glacier is a small one published in 1906.* The glacier had, however, been known long before that date and the name Bainbridge is in common use locally. We saw the glacier from a distance in 1905, and on August 3, 1908, visited it and mapped its front (Fig. 12).

The Bainbridge Glacier ends on a glacial flat, and the central part of the front is reached by the usual high tide, and thus an ice cliff is developed along this portion of the front. This cliff is approximately 100 feet in height and its top is composed of ragged ice pinnacles, singularly free from débris and showing in the sunlight a beautiful play of greenish blue colors. Near the northern part of the ice front is a push moraine, 10 feet high, in places directly at the edge of the ice and in other places as much as 60 feet from the ice. This moraine is very fresh, and probably was formed during the summer of 1908. The moraine includes fragments of trees, and towards the north encroaches upon a spruce forest, many of whose trees have been killed recently by being partially buried in glacial outwash (Fig. 14). On the south side of the front (Fig. 15) there is a small irregular bare zone of rock between the ice and the forest.

The photographs here reproduced (Figs. 13, 14 and 15) will mark the position of the front of the Bainbridge Glacier on August 3, 1908, and will be of service in determining future advance or retreat. In 1908 the ice was practically, if not absolutely, at its maximum advance since the growth of the present forest.

* Grant, U. S., Copper and other mineral resources of Prince William Sound. *Bull.* U. S. Geol. Survey No. 284, 1906, p. 79.

LAND RELIEFS THAT ARE TRUE TO NATURE

BY

GEORGE CARROLL CURTIS

The earth sciences have at present scarcely any accurate models of land forms corresponding with our museum specimens of plants and animals, although such models could render great service to geology and geography. The "natural history specimen" in geography is evidently the actual land itself as it exists in the field, be it mountain, glacier, or other form of the Earth's surface. By rational procedure the magnitude of the natural form can be reduced, and the scaling down of the vast dimensions to a size that can be conceived at a glance, brings it within a compass which can best be appreciated by human senses. Thus the characteristic forms of topography may become comprehensible in their details to the inexpert, and more thoroughly known by the specialist.

The naturalistic land model is a true reproduction of the existing outdoor form. It is both a true duplication as to surface and a faithful representation of the appearance and character of the object as it stands in the open. This implies that the model must reproduce, according to the scale of the work, not only the natural form of the land, but also represent the coloring and natural expression of the field as, under the time and conditions, it is depicted in the work. In theory, land models made on the naturalistic principle, *i. e.*, the reproduction of form and coloration as it exists, would reproduce the appearance of the natural phenomena taken; this is indeed the province and the test of the geographic model and its accuracy may be checked and proven by this comparison. This truthful reproduction may be called a picture in relief for it shows in three dimensions what photographs and paintings of topography present in two. It gives moreover not only the single view from one point which painting and photography supply, but vistas from an infinite number of positions as well. All topography in the field is much distorted by perspective, but the reduced model presents it in the least deflected presentation.

We have not been accustomed to see in our museums and laboratories, reliefs of land forms which afford true pictures of existing

landscape; yet that these may at least be approximated has been demonstrated in Europe by the Matterhorn model produced by Imfeldt of the Heim school and exhibited at Paris in 1900, and the Bora Bora coral island model produced in this country in 1907 and installed in the Agassiz Museum.

The advent of the naturalistic model during the past decade presages a happy achievement for geography. It seems probable that it may hold for this study an interest similar to that which museum specimens of plants and animals have brought to biological subjects. It has the advantage of suggesting natural scenery, wears a convincing aspect of truth, and imparts a more comprehensive and exact idea of the thing represented than can be given in any other way. The full bearing of such advantage as the naturalistic land model may give is not yet recognized, yet its general use may give a distinct impetus to the specific understanding and teaching of earth sciences.

As the naturalistic model has a part so important and interesting, especially in Geography, in creating a broader interest and clearer understanding let us inquire why so valuable a means did not long ago come into common use and why museums and schools in general have not become familiar with such equipment.

In the modern, better understanding of geographic forms, to which the American geographers, Powell, Dutton, Russell, Gilbert and Davis have so much contributed, and in the perfecting of dry plate photography lie two of the most potent influences without which the art of reproducing the forms of the earth in relief could not have reached its present position, even though it has, as yet, scarcely crossed the threshold of its development. The "raising up" of maps into relief has been the common conventional procedure in land relief work, but the naturalistic motif aims to reproduce nature. Simple as is this distinction, there is a large difference in the data required, in the work necessary, and in the conception of the subject involved, and there is a corresponding dissimilarity in results. The naturalistic model approaches in truth the field itself with the advantage of comprehensible size. The first fine map of Switzerland, a country which has been foremost in such work, was made from a modelled relief of the land.

There are found in the raised maps or conventional representations, any kind of exaggeration the maker may wish to introduce for his special purpose. He may put in or eliminate what he chooses, change vertical and horizontal scales, print names and spangle with barbarous colors; this being consistent with the dia-

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gram and the flat or the raised map. Not so with the naturalistic model; no such liberties can be taken; it is arbitrary and must reproduce the special place on the earth as it exists and appears. The purpose of this work is general not special, direct and exact not optional.

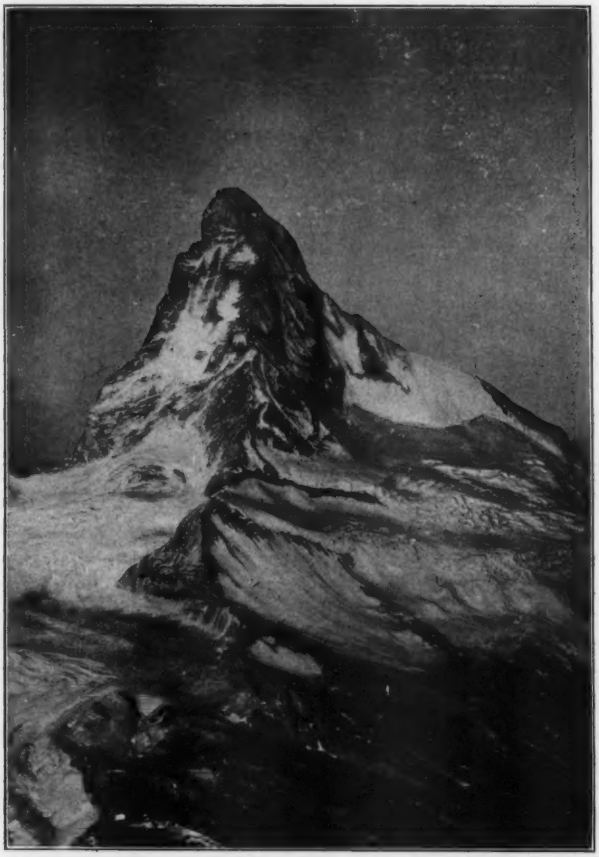

FIG. 1—A Naturalistic Model of the Matterhorn. By Imfeldt. (Heim School) Switzerland.

In discussing the naturalistic model, it is not necessary to include the raised map, but as this, the most superficial expression of the subject, has constituted the bulk of the work, so that the prevailing ideas have been largely derived from it, a clearer understanding

may be had from a brief comparison of the two classes. When a recognition of the difference of principle is gained, it is seen that one product involves merely mechanical execution, while the other involves the application of principles of rational interpretation of natural phenomena themselves as guide to every phase of execution. There is a mechanical element in both scientific and artistic work which is ever likely to be confused with the principles which may create it. This detail is liable to seem the more obvious part and is frequently the first thing noticed while the principles which have guided the hand of a master and perhaps unconsciously produced the technique, though the essence of the matter, are often overlooked.

The mechanical details of writing a treatise on natural topography are no more its essential part than the mechanical details which go to build up an expressive topographic relief; in each they are but the means to accomplish an end. The French military service has a routing machine which turns flat maps into raised maps, but no machine except a reasoning one can reproduce the expressive surface of the earth in its characteristic appearances. It may be added that no one but a thorough portrait artist can adequately represent the human countenance, and that a competent geographical artist is requisite truthfully to reproduce the complicated natural surface of the lands. Some arts have more mechanical detail than others, as drawing more than writing and modelling more than drawing. The principles which must govern all rational work in land relief have been overlooked by many because of this profusion of mechanical detail required in their execution.

It may seem strange that a work which can present the forms of the earth in the truest possible way should as yet be so little understood. One consideration however is the peculiar position which it occupies; it is one of the "borderland" subjects, lying between the earth sciences on one hand and the landscape arts on the other. The artist who has today a geologic training is very rare, and the work involved in reproducing landscape in its natural three dimensions is so much greater than on a flat surface by painting, that landscape painters would not likely venture far into it; on the other hand, the modern earth scientist has rarely a sound training in the fine arts and is apt to be unreceptive of the requisite artistic appreciation which may reach the intuitive mind. Thus this broad subject involving the application of science and art, with a knowledge of geology, painting and sculpture, has lain in an unprogressive eddy between the busy streams of their activities.

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FIG. 2.—Photograph of central portion Bora Bora Model. Showing central volcanic peaks, precipitous slopes crowded with tropic vegetation, narrow coastal plain with coconuts and native houses, sail in main lagoon. In foreground, sea breaking on the barrier coral reef.

It is the man with interests in both science and art who has helped most in advancing the subject of earth relief work. Albert Heim, leading geologist of Switzerland, artist by inclination and training, might be called the father of modern land relief modeling. In this country the geologist-artist combination produced the unequaled drawings of Western America topography of Prof. W. H. Holmes. Dr. R. T. McKenzie, a physician-artist, has added a new interest and knowledge to sculpture and anatomy in the naturalistic representation of the modern college athlete. In the naturalistic representation of animal and bird groups the artist-naturalists of the American Museum of Natural History, have brought a new and vivid presentation of the life and habitat of American fauna which has drawn a broader interest than museums of natural history have before been able to attract.

The past recalls as men of the artist-scientist type, Leonardo da Vinci, John Ruskin, Charles Eliot and Augustus Saint-Gaudens.

A comparison of the processes of making a raised map and a naturalistic land model should help those who are accustomed to consider a topographic relief as a matter of process and mechanical method alone, and not of principle, (the rational interpretation of natural earth phenomena in relief), to see the wide difference in procedure.

In 1904, Alexander Agassiz decided to have reproduced in relief, the coral island Bora Bora of the Society Archipelago.* The model was to reproduce the surface of the island as it exists in form, color and appearance, *i. e.*, it was to be "naturalistic." Fairly good maps made by the French Government were at hand and these gave sufficient data to prepare a raised map which indeed might have been forthwith constructed, and results similar to those of the common kind of work speedily turned out. It was recognized that such a procedure would give not more but less truth than was already possessed, and if a true model were to be made, the necessary data for it must be procured. This little coral island was visited, two months of field work were spent upon it, and all the data requisite to reproduce both form and color of the natural field were collected. The work included a complete photographic survey, covering every point of the surface from at least two separate stations. The data collected were brought back and incorporated into a relief (about 100 square feet in area). When views of the modeling, duplicated

* This island was chosen by Darwin ("Structure and Distribution of Coral Reefs," p. 3) to illustrate the type of high island with volcanic center surrounded by coral reef and inclosing a vegetation covered land rim.

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those made in the field from identical points, the sculpturing of the land forms was regarded as finished.

Duplicating the forms did not complete the naturalistic representation of the island. The coloration of rocks, bare and grassy slopes, trees and other vegetation, roads, beaches, reefs, etc., had been taken, and an attempt was made to carry out a naturalistic system of coloring which should give the season, time, and general conditions represented, in accordance with the recognized laws of color and principles of art. The entire face of the land was modeled as a portrait statue of the human figure would be produced by a figure sculpture. Several specially trained workers were placed on the purely mechanical parts, the construction taking over a year of steady labor.

A raised map of the same size and scale of the ordinary standard could have been completed in seven weeks, and without other aid than unskilled labor. A slab of plaster with the contour lines of the map drawn upon it, could have been cut down by a routing machine, the signs of the map painted upon the resulting relief, and the raised map would be complete. Inadequate as works from such a basis are and appear to be when such principles are applied to other natural objects than the forms of the lands, they nevertheless have been in common use as geographic reliefs.

That the more rational methods used in the coral island work* should produce a different class of work and a product quite dissimilar in appearance, was to be expected. At first glance a casual observer would mark a difference. People who had never seen a naturalistic land model were surprised to discover a topographic relief that gave the appearance of something they had seen out of doors. When they compared the modeled forms with photographs of the field, they saw that the artistically made shapes were like the natural features and being first attracted by the appearance of naturalness, then interested by the accuracy proven, they became impressed with the truth of the model finding in it reliability that had not hitherto been expected from this medium of earth representation. A glance at the naturalistic work gave even to Professor Agassiz a more complete understanding of the island than was before possible and to all who had never seen a coral atoll, the model gave the best opportunity for seeing what it is. The value of the naturalistic model to Geology, Geography and Museums of Natural History was demonstrated and those who gave it thought saw how

* The paucity of naturalistic land reliefs on exhibition in this country makes this reference necessary.

much clearer and more specific our preceptions of the forms of the earth will be when eventually we have its principal types reproduced in true naturalistic models.

If our museums and collections had never possessed naturalistic specimens of plants and animals, what would be our perception of the fauna and flora of the world? The naturalistic land model is to Geography what the natural animal specimen is to Zoölogy, and it has even a greater service, for outside the museum we may view many animals at close range, but the types of land forms are so vast that in the field our limits of vision will permit the examination of but a small part at a time.

The development of the art of land representation in relief has been retarded by the peculiar conditions surrounding it. The art of earth sculpture is akin to that of figure sculpture, both of which are parts of a large subject, including the representation in relief, of the earth and its forms both organic and inorganic. The division of the inorganic which includes the sculpture of the lands, is subject to the same laws as that of the organic which includes the human figure and the sculpturing of animals. Again, the reproduction of portions of the Earth's surface, forms and coloration in relief, is a representation of the same landscapes in three dimensions which painters represent with colors and canvas in two dimensions. The same general laws of science and art apply to reliefs of the land as to the sculpturing of the human figure, and the painting of natural landscapes. That each portion of the land's surface gives a definite problem in natural history whose proper solution in relief must be obtained through consistently following the development of science and laws of art appears to have been largely overlooked.

To understand the principles of earth sculpture one must be familiar with the earth science on which it depends as the figure sculptor must know human anatomy the basis of figure reproduction; moreover as successful painting and sculpture are guided by the laws and rules of good art, so a knowledge of these same rules and laws must guide the understanding and practice of the art of representing the lands in relief. It is a subject with a dual basis of art and science. As with Paleobotany both geology and botany must be studied, so in topographic modeling adequate work or criticism must be based on the fine arts as well as earth science. While this combination has been quite rare in individuals, in groups whether of artists on the one hand or scientists on the other it has been wholly wanting, and little or no concerted action to forward this work has been taken. Artists being largely unacquainted with

the scientific aspect have passed it by, and the average man in earth science had small interest in the artistic basis.

What development the work of faithful reproduction of the forms of our Earth has attained has come mostly through the support of men with interests on both sides of the dual subject, men of both scientific training and artistic appreciation. Among those engaged in earth science in Europe, Heim and his pupil Imfeldt of Zürich, and Schrader of Paris have done most by their own work while in America, Agassiz, McKim, Saint-Gaudens, Burnham and Olmsted, men of both scientific and artistic training, have, from the point of view of dual relation, recognized the unequalled value of the naturalistic land model to aid in their special activities and have lent support and encouragement to its promotion. When we realize that until within the last five years, there have been in American institutions (with the possible exception of some small idealistic reliefs by Prof. Heim) few if any naturalistic topographic models, it is not strange that there are still men eminent in the earth sciences, who do not yet clearly distinguish between the principle of the naturalistic land model and the raised map.

In the interest of more specific and wide spread appreciation of geographic forms and types, it is unfortunate that the smaller side of the broad subject of earth sculpture has alone been generally recognized. An impression that process, addition or suppression of mechanical details is all there can be in the subject has been widely spread. One conversant with art in any form, be it in letters, music, painting or other means of expressing natural truth, may see the fallacy of such a conception, for in all arts which interpret nature, method is but a means to accomplish a purpose.

When a master sculptor chisels the human form, his knowledge and fine perception of the subject show in the handiwork, they guide the mechanical steps of execution and may produce even without design, a certain technique; these cuttings, skillful contrivances, humps, hollows and processes are not in themselves the important part, but merely the mediums through which ideas are expressed.

No mechanic who can see only the details and processes of construction, (these must always differ according to the infinitely varied problems which natural topography and scenery present), has the knowledge and perception to ever produce a good piece of naturalistic art of whatsoever sort, lacking as he does the ability to see that which the well trained mind of the artist grasps as essential. Nor can the scientist untrained and unversed in artistry rightly expect to achieve successful results in this medium of naturalistic

expression. To accept as adequate in earth sculpture results that would be universally unacceptable in figure sculpture is inconsistent with the aspect of the surface of our planet as it appears to men of scientific training and vision. To produce results in land modeling equal to those of good figure sculpture, it is necessary to employ knowledge, training and perception of comparable quality.

One of the first functions of the naturalistic geographical model is to correct the false impressions of slope and relief which most of the old raised maps have given us. Many leading teachers today seem unable to recognize truthfully modeled land slopes when they are so represented, holding from old association that they must be too steep or very inexact. As yet, largely for lack of true models, they have not become accustomed to expect in earth reliefs reliability and true reproduction of natural form. Gradually the naturalistic model may rectify false impressions; and the doubting spectator, by comparing the model with photographs of the field can satisfy himself of the reliability of the medium.

Without such reliefs the teacher of Geography lacks the most comprehensive, truthful and convincing means of conveying the facts of earth forms.*

A far wider and keener interest will be attracted to the earth sciences as a logical result of applying to the intricate forms of natural landscape, the same degree of knowledge, study and training that is already applied to the well-known naturalistic arts.

Until our museums possess naturalistic specimens of existing types of land forms a most important work and duty in the earth sciences will remain undone and we shall be without the most complete and effective means known for presenting the great features of Geography with their splendid forms of mountain scenery and various types of landscape.

* As yet naturalistic gepgraphical models have not been commonly adopted in schools, though their possible service in imparting a vital and truthful interest to the study is probably enormous. Teachers have not yet been trained in their use and value, and it is only within the past few years that such apparatus has been placed within reach of the common schools.

THE ECONOMIC CLIMATOLOGY OF THE COFFEE DISTRICT OF SÃO PAULO, BRAZIL

BY

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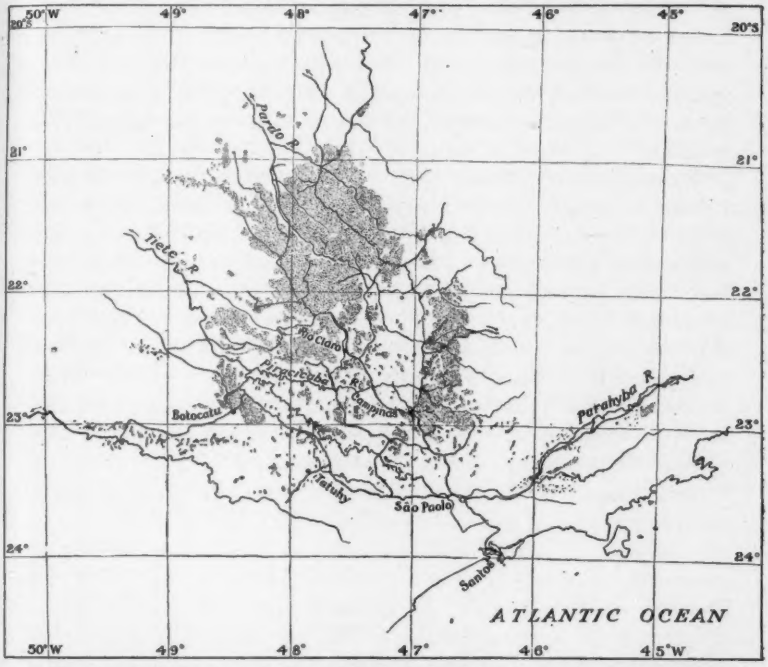
NEED OF "FIELD WORK" IN CLIMATOLOGY: The teacher of climatology, no less than the teacher of geology or of physiography, should travel. He should do "field work." If he is to have a clear understanding of the climates of the world he cannot be satisfied with the published numerical data, no matter how accurate these may be, or how carefully they have been discussed. He will, in addition, want to visit as many parts of the world as possible, in order that he may himself become familiar with the various weather types. In this way, and in no other, can climatic description become really alive, and can the teacher of climatology do his best work for his classes. The natural objection, that it is impossible for one person to make any adequate "field study" of this sort, because of the immense number of different weather types the world over, is a valid one to a certain degree, but it should be remembered that in many latitudes the weather conditions are so uniform, day after day, that a day or two spent there suffices to give a very fair idea of the climate. In the heart of the trade wind belt, at sea, a day's weather and the climate are thus nearly identical. And in many districts, especially within the tropics, where there are two well-marked seasons, a day or two in each of these seasons often suffices to give a reasonably good idea of the character of the whole year.

To the practical climatologist, who concerns himself with applied, rather than with purely theoretical climatology, this "field study" of climate is obviously of peculiar interest in a locality where the climatic conditions are of special importance to man, because of their relation to some particular crop, or to some industry, or to health. There is thus a natural difference in interest in the economic climatology of different regions. For various reasons the writer has lately had his attention drawn to the immense importance of the Brazilian coffee crop. This paper deals with certain climatic aspects of coffee cultivation and of preparation for market which presented themselves during a recent summer trip to Brazil, which was undertaken in order to make first-hand observations of the economic climatology of the Brazilian coffee district.

DISTRIBUTION OF COFFEE OVER THE WORLD: The coffee belt of the world roughly corresponds—conveniently for our memories—with the broad zone within the Tropics, although latitudes 23.5° N. and S. are not to be thought of as rigidly limiting the countries in which coffee grows. The extreme limits of *Coffea Arabica* are generally given as 28° N. and 30° S. Within this great area there are differences of rainfall, both as to amounts and season of occurrence; of temperature; of exposure; of altitude; of soil. It is, therefore,



Map of the Coffee District in the State of São Paulo, Brazil. Scale 1:5,500,000. Stippled areas represent coffee districts. "São Paolo" should read "São Paulo." Based on a map published in 1907 by the Commissão Geográphica e Geológica de São Paulo, scale 1:2,000,000.

impossible to give any rigid climatic limitations for coffee culture, or to draw a map which shall indicate the climates where coffee might be profitably cultivated, valuable as such a map would obviously be to the economic climatologist. Fortunately for man. *Coffea Arabica* is not nearly so exacting in regard to its climatic requirements as are many other tropical plants of economic importance. It does well on lowlands near the equator, and it also does well at altitudes of 2,000 feet near the margins of the tropical belt. By far

the greater part of the world's coffee crop, however, comes, not from the middle of the belt, near the equator, but from the hill-slopes or plateaus some few hundreds of feet above sea-level near the "temperate zones." In other words, coffee succeeds best in the more temperate climates of the tropical zone, in just those climates which are best suited to Europeans and North Americans. To-day, coffee comes chiefly from the New World, and from south of the equator. Temperatures fairly high and uniform (monthly means of 60° or 65° to 75° or 80° Fahr.), and rainfall in reasonable amount (*i. e.*, higher than that of most of the "temperate zones"), say 60 inches and over, are generally found. Excessive humidity is injurious because of its effect upon the diseases of the coffee plant, and upon the growth of weeds, although otherwise a high relative humidity is beneficial.

Naturally, the different species of coffee differ greatly in their relation to climate, some doing better at higher elevations, and others at lower; some withstanding drought better, and others thriving only where there is a more even distribution of rainfall; some being more and others less resistant to cold. The distribution of rainfall is an important factor, a dry season during harvest-time being a very desirable feature, especially where sun-drying is practised. The dry winter season of Brazil is worth millions of dollars to the coffee-planters of that country. In general, climates which are very hot and very damp are somewhat less favorable than those which have a relatively dry season during certain months.

THE BRAZILIAN COFFEE DISTRICT: Among all the coffee-producing countries of the world, Brazil stands pre-eminent. She is the colossus. She alone sends out annually about three-quarters of the world's total coffee crop. No reading of books on coffee can give any adequate idea of the extraordinary position which coffee occupies in the world's commerce. To appreciate this remarkable situation one must travel for hour after hour through the rich coffee plantations of Brazil; must live in their midst, and must make a study of the methods of planting, cultivating, harvesting and preparing the coffee for market, including the wonderfully ingenious machinery which has been invented to deal with this one particular crop. The coffee district of Brazil is situated in the highland or plateau region to the south and west of the city of Rio de Janeiro, chiefly in the state of São Paulo (latitudes 20°-25° S., longitudes 44°-53° W.), although the adjacent states of Minas Geraes, Espirito Santo and Rio de Janeiro are also coffee producers. This "Brazilian Highland," so-called, is the great table-land of central and southern

Brazil, averaging about 2,000 to 3,000 feet above sea-level; sloping gently inland and westward; falling off abruptly to the sea on the east. Open campos and scattering woodlands occupy the greater part of its surface. The eastern portion is mountainous, the most marked feature being the sea-coast mountain ranges of the Serra do Mar and the Serra do Mantiqueira. The western portion belongs to the basin of the Parana River, and is crossed by several small mountain ranges, roughly parallel to the Serra do Mar. The coffee country *par excellence* is a gently-rolling district a little south of the Tropic of Capricorn.

The importance of the Brazilian coffee crop in the world's markets naturally draws attention to the particular small section of that great republic in which the conditions have proved so favorable for the cultivation and preparation of this remarkable plant. Those who have travelled for hours through those oceans of coffee trees need no further assurance that this is the center of the world's coffee crop. Nowhere else in the world does coffee grow more luxuriantly; nowhere else does it find a more congenial climate; nowhere else does it require less care; nowhere else is it more free from enemies. Such a condition of things is unique; it is phenomenal; it irresistibly attracts the traveler. He is drawn to it as he is drawn to visit the world's greatest diamond mine, or steel plant, or ship-yard, or waterfall. It matters little in such a country whether there are (as statistics say) over 15,000 coffee plantations. It matters little whether there are 600,000,000 or 700,000,000 coffee trees. It matters little whether the invested capital is $500,000,000, or more, or less. It matters little, because figures mean little to most of us, and because the vastness, and the extent, and the importance of the coffee industry are here so obvious without any statistics.

The most natural way for a visitor from the United States to enter the Brazilian coffee country is to land at Rio de Janeiro, and to travel thence by train to the city of São Paulo, a distance of about 300 miles to the southwest. This trip, through the Parahyba Valley, dusty as it is in winter, and monotonous, is nevertheless interesting from the fact that here used to be the centre of coffee culture. The coffee tree was first introduced into the city of Rio de Janeiro about 1750 by a monk, who planted it in the garden of the monastery of San Antonio. Early in the last century the cultivation of coffee became recognized as a profitable occupation, and gradually the hillsides of the state of Rio de Janeiro, especially in the Parahyba Valley, became covered with coffee trees. The crop was so successful that it helped greatly to give Rio its prestige as a commercial centre,

just as, in recent years, coffee has been the chief impetus behind the extraordinary development of the cities of São Paulo and Santos, and has led to the building of most of the railroads in the state of São Paulo. The traveler between Rio and São Paulo may today see from the train many abandoned coffee plantations, dry and dead, whose owners became wealthy men, but whose manor-houses and outbuildings are falling into ruins. In fact, much of this country today looks forlorn and neglected. Whoever looks at these barren hillsides, especially in winter, is easily tempted to infer that a change of climate has made coffee-culture in this district impossible. Such is not the case. The fact is that coffee has been found to succeed so much better in the state of São Paulo, that it no longer pays to keep up most of these old plantations in the state of Rio de Janeiro. Exhaustion of the soil; the development of new railroads in the country farther south; and other factors have combined to produce the change here noted. Nevertheless, coffee culture has not been entirely abandoned in this district. The traveler may still see thriving plantations here and there from the train. But sugar cane and other crops are taking the lead. In this district the first experience in Brazilian coffee culture was gained. Interesting studies were here made as to the value of longer and shorter exposure to sunshine. A classification into *soalheiro* and *norwega* lands separated the slopes into those which had the longest duration of sunshine (*soalheiro*) and those which had sunshine only in the early morning (*norwegas*). Many local peculiarities of climate were discovered by the early coffee planters of the Parahyba Valley. Certain districts which were protected against cool winds were found to require coffee culture at greater altitudes. In some districts dry northerly winds were found to be injurious, while in others they were welcomed. Van Delden Laërne has called attention to many of these very interesting local climatic controls over coffee culture in this Rio zone, but the day has passed for any further detailed studies along these lines, for the Rio coffee belt is largely no more. Van Delden Laërne, in 1885, divided the coffee country into two zones, (1) the Rio or maritime zone, where the climate is to some extent controlled by the ocean and where coffee must be cultivated at from 250 to 350 meters above sea-level, and (2) the Santos zone, to the west and southwest, separated from the ocean by the Serra do Mar, and open to the southwest winds (*pamperos*) from the Argentine plains. The same writer rejects the division suggested by Couty, into a section where the soil is the chief control and into one where climate is the only measure of success.

The São Paulo coffee district is easily reached in a day's journey by rail from the city of São Paulo, along any one of the several lines of railway which run in a northerly and northwesterly direction from the city. Campinas (alt. 2,165 ft., 84.5 miles from the sea) was formerly the center of the best coffee plantations, but in recent years the rapid extension of the area inland and northward has displaced the center further to the northwest. In the vicinity of Campinas, however, there is still much coffee, and the traveler from São Paulo here sees his first large coffee plantations. From here on it is a journey of wonderful interest to any observing person, in spite of the red dust which in winter is very disagreeable, although the ballasting of some of the railroads with stone has recently greatly improved matters. Coffee trees are everywhere; coffee trees by the hundreds of thousands; coffee trees by the million. Monotonous the view is, if you will. To many it has seemed so. But to anyone who really enters into the spirit of the place the monotony becomes variety. It is inspiring to be at the very heart of this country whose product is so valuable that it has made, and will make fortunes; that its varying prices are quoted in the daily papers all over the civilized world; that a national government has actually gone into the business of "cornering" it.

Many factors are concerned in producing the extraordinarily favorable conditions which have made this small part of Brazil the most important coffee country in the world. Among these are soil, altitude, exposure, absence of many insect pests and diseases. One fundamental control is, however, to be found in the climate. It is because of its relation to coffee culture that the climate of the state of São Paulo has such a live interest for the climatologist, an interest which is not satisfied with any published studies of this climate. Such an interest compels a personal visit to this wonderful coffee country itself in order that the actual weather conditions may be seen and felt; so that their control over the cultivation and preparation of the coffee may be studied on the ground. Such was the object of the writer in making a trip to Brazil in the summer of 1910: to make some observations, at first hand, of the economic climatology of the coffee-district of São Paulo. Through the courtesy of Dr. Plinio Da Silva Prado (Harvard, '95), of São Paulo, he was enabled to visit two well-known and representative Brazilian coffee fazendas, that of Santa Veridiana, belonging to Conselheiro Antonio Prado, with 500,000 trees, and that of Santa Cruz, at Elihu Root, belonging to the Chaves family, with 450,000 trees. The latter was selected as the fazenda to be visited by Secretary (now Senator) Root during his South American trip, and the railroad station was then renamed

in his honor. At both these fazendas the writer was entertained with delightful hospitality, and was given every facility to study each step in the process of cultivating the coffee and of preparing it for market.

THE CLIMATE: Fortunately for the layman, the essential characteristics of the climatology of São Paulo are simple and easily remembered. Fortunately for the climatologist, São Paulo has a very considerable series of excellent meteorological observations, which were begun in 1887 under the direction of Dr. Orville A. Derby, of the *Commissão Geográphica e Geológica de São Paulo*, and constitute the most complete series available for any part of Brazil, or for any portion of tropical South America. To Dr. E. L. Voss we owe a very acceptable study and summary of these data, and it is to Dr. Voss's monograph that everyone must go for the most complete account of São Paulo climate ("Beiträge zur Klimatologie der südlichen Staaten von Brasilien; *Pet. Mitt., Ergänzungsheft* 145, Gotha, 1903), although the excellent summary in Hann's "Handbuch der Klimatologie" 3d ed., Vol. II[a] pp. 392, 394, 411-413, will probably suffice for most persons.

Singularly favorable as regards climate is the situation of the famous São Paulo coffee district. And it is clearly this favorable, we may say ideal, situation which has contributed largely towards making the district famous for its coffee. Lying near the margin of the southeast trade belt, it is not too far from the equator to be reached by the equatorial rains in the summer, and a sufficient rainfall is thus assured for the proper growth of the coffee trees. On the other hand, the prevalence of the trades during the winter months brings the dry season which is of such immense economic importance in the harvesting and drying of the crop. Further, being near the outer limits of the "hot belt," and at an altitude of several hundred feet above sea-level, the heat is not so intense as to necessitate any protection against the sun except in the case of the very young trees. On the other hand, the danger from frost, which is certainly present in winter, has been greatly exaggerated by many writers. Frosts do occur, but it is only at intervals of several years (say six or seven) that they rarely do any damage which is worth much consideration. Finally, as regards relative humidity, the conditions are such that the air is dry enough for outdoor drying in winter, and not so damp as to promote the excessive growth of weeds in summer. Such a combination of climatic conditions is indeed an ideal one. There are few districts in the world whose economic climatology is more important. A visit to such a country is of the greatest interest to the climatologist.

The accompanying table (Table A) gives a general idea, so far as printed data can do so, of the temperatures of the São Paulo coffee district. Of the five stations here included, Rio Claro, Campinas and Botucatú are the best representatives. The city of São Paulo itself is not in the coffee country. The three first-named stations agree in having six (or seven) months with mean temperatures over 68° Fahr. For this reason, this famous coffee country comes within Köppen's "subtropical belt of the temperate zone," whose characteristics are that four to eleven months are "hot" (mean temperature over 68°) and one to eight months are "temperate" (50°-68°).* The mean annual temperatures average between 65° and 70°. January is usually the warmest month and June the coolest. The ranges, annual, monthly and diurnal, as a rule increase inland. The mean annual ranges in the coffee country average from 12° to 15°. In summer the thermometer may rise to near, or even above, 100°. The extremes of summer heat are brought by northwesterly winds, from the interior, which are also extremely disagreeable because of their carrying large quantities of fine red dust. We have a story, on excellent authority, which illustrates the intensity of the summer heat in the coffee country. During a spell of intense heat, and drought, when everything was "sizzling hot," a large snake which started to crawl across an iron surface, was seen to die almost instantly.

TABLE A

TEMPERATURES IN THE SÃO PAULO COFFEE DISTRICT (HANN)

STATION	SÃO PAULO	TATUHY	RIO CLARO	CAMPINAS	BOTUCATÚ
S. Lat.	23°33′	23°27′	22°25′	22°58′	22°50′
W. Long.	46°38′	47°46′	47°39′	47° 7′	48°25′
Altitude	2493 ft.	1968.5 ft.	2000 ft.	2165 ft.	2625 ft.
No. of Years	13	12	11	10	5
Dist. from Ocean (miles)	32.3	84.5	128	84.5	134.2
Jan.	**71.1°**	**73.2°**	**75.6°**	**73.2°**	72.7°
Feb.	70.7°	72.3°	74.7°	72.5°	72.1°
Mar	70.0°	71.8°	74.3°	72.1°	71.6°
Apr.	65.7°	66.4°	70.2°	68.0°	66.9°
May	61.2°	61.9°	64.9°	63.3°	61.9°
June	57.9°	*58.3°*	*61.5°*	*60.4°*	*58.5°*
July	*57.6°*	58.7°	61.9°	60.6°	60.1°
Aug.	60.1°	61.7°	65.7°	64.2°	63.7°
Sept.	61.9°	63.0°	67.6°	65.3°	65.1°
Oct.	64.6°	67.1°	71.1°	68.2°	68.9°
Nov.	66.7°	69.8°	72.7°	70.0°	71.1°
Dec.	70.0°	73.0°	74.8°	72.7°	**73.8°**
Mean Annual	64.8°	66.4°	69.6°	67.6°	67.3°
Mean Annual Range	13.5°	15.0°	14.0°	12.8°	15.3°
Absolute Maximum	91.6°	(108.5°)	(97.3°)	(98.1°)	(100.0°)
Absolute Minimum	35.2°	(28.8°)	(28.8°)	(31.6°)	(32.0°)

N. B. The maximum and minimum given for São Paulo are mean annual maximum and minimum.

* See R. DeC. Ward: "Climate." pp. 28–29.

Obviously, the summer months, with their high temperatures and heavy rains, are not the best season for visiting the coffee district. We must go there in winter if we would enjoy the climate at its best. A glance at the table shows that the winter months have mean temperatures of, roughly, between 60° and 65°, and that the minima have fallen to freezing, and somewhat below. But what does that really tell us about the winter weather types—those wonderful days, of which the writer has seen many, on the campos of southern São Paulo and of Paraná in 1908 and in the coffee district in 1910, with their cool, crisp, sparkling air of early morning; their warm noon hours, their refreshing evenings, and their gloriously clear skies? No wonder is it that Europeans have settled so largely in the southern states of Brazil, for the climate is a "white man's climate." During his stay at the coffee fazendas in August, 1910, the writer found the temperatures of the early mornings (about 7 A. M.) between about 50° and 60°, or a few degrees over 60°; in the warmest hours of the day it was between 80° and 82°; and in the early evening (6-7 P. M.) about 75°. These are ideal conditions for health and pleasure in the dry air of the winter months.* Add to such temperatures a sky which is prevailingly cloudless or has only scattering clouds; and a light wind, and you have a combination of elements which should satisfy all but the most exacting seeker after a congenial climate.

The writer obtained temperatures of 55°-60° in the city of São Paulo in August, 1910, in the morning and evening, and 70°-75° in the early afternoon. The weather was clear or cloudless all the time, and the wind light S. E. The prevailing direction of the winds (the southeast trades) is very generally indicated by the unsymmetrical growth of many trees which often serve, here as elsewhere, as excellent wind vanes. Local topography frequently deflects the trades into other directions than southeast, over limited areas, as the writer has had occasion to observe. The general southeasterly winds weaken in summer, under the high sun, following the usual law in these latitudes, and are replaced by hot winds from the northwest. The latter are especially marked in the interior, where they are so distinct that Voss has called them the northwest monsoon. It is these summer winds, or calms, which bring the rains. Following the wind changes, the relative humidity is usually higher in summer and lower in winter, although near the ocean, where the trades are both cooler and damper than in the interior, the humidity is high through the year, and showers are not uncommon even in winter. It is asserted

* In the writer's note book, Aug. 13, 1910, there is this entry: "For a teacher of climatology a journey of 10,000 miles for one such day is well worth while."

by Voss that rivers, swamps and forests locally increase the humidity, but that the coffee plantations have no such effect. Cloudiness is at a maximum in January and February in the interior, and at a minimum in July and August, following the seasonal changes in general weather conditions.

The rainfall over the coffee district averages between about 45 and 60 inches. The rainfall of the coast is generally a good deal heavier than that of the interior on account of the free exposure of the former, with its mountain ranges, to the easterly trade winds. Santos, on the coast, at sea-level, has about 90 inches, while the annual mean at Alto da Serra (2,625 feet), the highest point on the line between Santos and São Paulo (city), is 145.55 inches. São Paulo itself has just over 50 inches. The coffee district is therefore plentifully watered, a fact which not only greatly facilitates the harvesting and preparation of the coffee, but also provides a certain amount of river transportation. The general conditions of rainfall for this region are illustrated in the data given in Table B for three representative stations. This distribution of rainfall furnishes a good illustration of the so-called "tropical type," which is found at the margins of the trades, where the equatorial rain belt encroaches, in the summer months, upon the trade wind area. January is usually the rainiest and July the driest month, but even the so-called "dry season" has some precipitation. The rain probability is also greatest and least in these same months. By seasons the probability of rain at Rio Claro and at Campinas is as follows:

	SUMMER	AUTUMN	WINTER	SPRING
Rio Claro	51	25	13	32
Campinas	57	28	16	35

In the interior, the hours from 2 to 4 P. M. are on the whole the rainiest. Heavy thunderstorms, not infrequently accompanied by hail, occur in summer. The hail may seriously injure the coffee trees, even, as some authors have said, "almost totally destroying whole plantations." The present writer was, however, unable to discover that damage by hail is really much feared by the fazendeiros,

TABLE B

MONTHLY RAINFALLS IN THE COFFEE DISTRICT (VOSS)
(in inches, to nearest hundredth)

STATION	YEARS	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY
Campinas	10	7.13	**10.87**	8.74	7.48	2.79	2.72	2.16	*0.71*
Rio Claro	11	7.01	**9.21**	8.07	5.47	2.60	2.24	1.97	*0.43*
Botucatú	3	3.42	**9.25**	7.60	7.36	1.73	1.77	2.01	0.59

	AUG.	SEPT.	OCT.	NOV.	YEAR
Campinas	1.34	3.23	5.59	6.46	59.72
Rio Claro	1.18	3.46	4.68	7.01	53.78
Botucatú	*0.47*	1.77	5.00	5.00	46.30

and he could find no case of hail insurance. As the *administrador* of one coffee fazenda said, "the hail falls in such narrow belts that I am not afraid of its doing much damage." And that seems to be the general opinion. That the hail-storms of the campos of *southern* Brazil may be very severe the writer had occasion to observe in 1908 when crossing the state of Paraná, and it may well be that even in the coffee district men and animals are sometimes injured, as reported by some writers. One economic aspect of heavy rainfalls in this country is their effect in washing the roads, which are none of the best even in the dry season, and making travel, even in the famous Brazilian "trolley" (a kind of rude buckboard) difficult. Nocturnal radiation fogs are very common, especially in winter, in the valleys and on the lower slopes of the hills. No traveler who is obliged to be up early in order to take the morning trains, which very commonly start at about 6 A. M., can fail to note the frequent occurrence of these fogs. Fogs, and heavy dews, are doubtless a very effective aid in providing moisture for vegetation at a time when such moisture is most needed. The writer, during his recent trip, made special note of the occurrence of fogs and of very heavy dews. The former doubtless often serve as a protection against frost, while the latter may be injurious to coffee which is spread out on the drying-grounds, unless coverings are used at night.

SOIL: It must not be supposed that no emphasis is to be laid upon the soil of the São Paulo coffee district in helping to produce the wonderfully favorable conditions of that region. In the older, or eastern coffee belt of Rio de Janeiro and of eastern São Paulo the soil is decomposed granite and gneiss of Archaean age. But the interior of São Paulo is composed chiefly of sandstones and shales of Devonian and Carboniferous age, traversed by numerous dikes and intrusive masses of diorite and other eruptives. It is the decomposition of the latter which produces the rich red soil that has become famous as the *terra rossa* and is regarded as the best for coffee culture, being wonderfully fertile, very rich in potash, and containing much iron. The *terra rossa* lands are the most valuable and most keenly desired by coffee planters. They are adapted for the growth of coffee as no other soils seem to be, and the term has become almost synonymous with "a soil suitable for coffee planting." For various modifications of this soil the terms *terra vermelha* and *terra massapé* are used. The sandstones yield *terra area* (sandy soil) which is further classified as *preta* (black), or *branca* (grey), etc. But the red soil is by far the best, and is justly famous where-

ever coffee cultivation is discussed. The traveler very soon learns to predict his approach to a coffee plantation simply by noting the occurrence of red soil, seen from the window of the train.

SOME CONTROLS OF CLIMATE OVER COFFEE CULTIVATION: We have, then, in the state of São Paulo, a rare combination of elements singularly favorable to coffee culture. Favorable as these conditions have shown themselves to be, man has, nevertheless, been obliged to adapt his methods of cultivation and his methods of preparation to the climate in a number of rather striking ways. The climatic control is to be seen throughout, if one is only on the watch for it. Exactly such facts as these are what the economic climatologist is interested in: it is in order to see them that he is anxious to do "field-work," instead of remaining at his desk at home. Thus, at the very beginning of the plantation, when the virgin forest which still covers the hillsides of the future coffee fazenda is first attacked, the trees are cut down at the end of the rains, and are allowed to dry during the winter months. Towards the close of the dry season, when trees and shrubs are in their best condition for burning, the fires are set, and the whole mass of tangled vegetation is wiped out, excepting perhaps a few tall, dead trunks, which stand for years, silent witnesses to the departed glory of the forest and to its replacement by a growth of trees from which man derives greater economic advantage. This burning, it may be noted, is begun by preference after the night's dew has evaporated. During the dry season there are many field and forest fires in progress throughout this great interior campo country of Brazil, but fire is not feared among the coffee trees, because they are separated from one another and because the roads through the plantation make the control of fire an easy thing. Towards the latter part of the winter, when vegetation is thoroughly dried up, the smoke from burning grass and brush often becomes so thick that the sky is yellow and the sun is partly obscured. The coffee seeds are planted, and the young trees are started in wicker baskets kept under the shade of the forest trees, which are almost always to be found in some part of every fazenda, in order to protect the youthful plants from the sun. In eight to twelve months after planting, the young seedlings are removed from the nurseries to the plantations, where they are placed at distances of 4-5 meters apart. The transplanting should be done at the beginning of the rainy season, and preferably in damp and cloudy weather. The seedlings are set into circular holes dug into the ground, and over the tops of these holes, above the little trees, is laid a loose thatch-

work of corn stalks, straw, twigs or leaves, to serve as a protection against excessive heat, and against frost, but the former seems to be the principal danger in mind. Except in their earliest stages, the coffee trees in São Paulo are not shaded for protection against the sun. In many of the other coffee countries, shade is necessary, and banana trees are very commonly used to provide this protection. In fact, the whole matter of the best shade trees to be used under different conditions has been carefully studied. Such trees as close up their leaves at night, thus offering less obstruction to radiation from the leaves of the coffee itself and resulting in a heavier dew deposit upon the latter, are mentioned by one authority on coffee as being the most desirable. This is surely an interesting example of botany applied to economic climatology. It is apparent that when cultivated near the equator, where insolation is more intense, shade is necessary, whereas towards the margins of the tropical zone, as in São Paulo, such protection is not needed. In its natural state, coffee does best under shade.

Frost is the climatic element which the São Paulo coffee planters fear most, and yet many of the accounts which have been printed exaggerate very much the danger which may result therefrom. The writer was unable to find any considerable fear of frost in the minds of the superintendents of the coffee fazendas with whom he talked. They realize that frost is likely to occur any year; that there have been occasions when large numbers of trees have been damaged, temporarily or permanently; but that no appreciable injury comes oftener than about once in five or six years. They rely on the protection which they give the young plants against sunshine to protect them equally well from frost, and they are very careful indeed to plant their coffee at altitudes which will bring the trees above the frost limits. "Smudges" are not used, so far as the writer was able to ascertain. The smaller danger from frost on the hillsides than in the valley bottoms and on the lowlands has taught the *fazendeiros* to begin to plant coffee at about 600 meters, more or less, above sea-level. The exact altitude varies locally, according to the topography. Each *fazendeiro* knows the usual "frost holes" on his own fazenda, and recognizes the well-known "streakiness" or "patchiness" of frost, which sometimes plays curious pranks in the damage it does. There is no more striking feature of the climatology of the Brazilian coffee district than this marked dependence of the altitude at which the trees are planted upon frost occurrence. Over and over again even the casual traveler cannot fail to be impressed with the fact, plainly visible from the car windows, that the rows of coffee trees do not

extend all the way to the bottom of most of the slopes, but stop short at a certain definite height, corn or some other crop occupying the lowest slopes and the valley bottoms.

The writer, on his recent trip, saw some coffee trees on the *lower* slopes of the hills frost bitten. It has been noted by previous writers that coffee trees may be planted at lower levels where there is a stream flowing through the valley, because under such conditions the relative humidity is higher, and fog, which serves as a protection against frost, is more likely to occur than where there is no river. In many coffee districts where the trees are liable to injury by high winds, or by winds which bring excessive heat or cold, protected situations are sought for the plantations and wind-breaks are planted, but in Brazil this precaution does not seem to be necessary. It is customary, in countries where strong prevailing winds are to be guarded against, to form a judgment as to the exposure of any given locality where coffee-planting is to be undertaken by noting whether the trees of the natural forest are wind-blown. If these show unsymmetrical growth, it is clear that the coffee trees will also suffer. The importance of an abundance of running water in preparing the coffee for market is one of the most striking lessons which the visitor to a coffee fazenda will learn. Hence a sufficiently abundant rainfall is an element of the climate which is essential. There is still another respect in which the São Paulo coffee district is singularly favored, climatically. To one who reads the extensive literature of coffee, it is a most striking fact that Brazil has suffered so little, as compared with most of the other coffee countries, from coffee pests and diseases. This is partly, we may even say largely, the result of the exceptionally favorable climate. Certain of the coffee leaf diseases are pretty surely brought on by a weak condition of the shrubs resulting from prolonged exposure to drought. Other diseases, such as "rot," are due to excessive moisture and low temperatures. Finally, the climate of São Paulo, being neither very hot nor very damp, is far less favorable to the growth of noxious weeds than is the case in many other coffee countries.

THE HARVEST: The harvest in Brazil begins in May and lasts until August or September. It therefore comes in the dry season. The harvest was nearly over during the writer's visit in the middle of August, 1910. The climatic conditions which provide this dry season for the harvest, and for drying the berries, are of peculiar and very marked economic importance. The size of the crop may vary greatly from year to year, depending chiefly upon preceding weather conditions.

Coffee as we know it in the grocery store is the seed of the coffee berry, which is red when ripe, and has about the size and appearance of a small cherry, or a cranberry. The berry normally contains two seeds, flat on one side, convex on the other, the flat sides being together. These seeds are imbedded in a mucilaginous, saccharine, whitish pulp, which has an insipid, sweetish taste, and are themselves further enclosed in two envelopes. The inner of these, when dry, is a delicate, closely adherent, very thin covering, much like the thin skin which covers the white onion, and is known as the "silver-skin." It is easily removed by friction when dry. Outside of this inner covering comes a somewhat tougher, thicker and more loosely fitting envelope, not unlike the husk of wheat. The preparation of coffee for market involves the removal, from the inner seeds or beans, of the outside skin, the pulp and the two inner coverings. These intervening stages involve much care and good judgment, as well as the use of complicated and expensive machinery. The processes consist in: (1) the removal of the outside skin and of the pulp by maceration in water; (2) the washing and drying of the beans, after the removal of the pulp, but with the two inner coverings still on the beans; (3) the removal, when dry, of these two inner coverings, and (4) the sorting of the beans according to size and weight. Among these different processes the one which has the most interest for the climatologist is the drying stage. After the outer skin and pulp have been removed, and the beans have been washed and allowed to ferment a little, they are taken to the drying-grounds (*terreiros*).

Drying the Coffee: The process of drying the coffee beans is the stage in which the greatest skill and care and good judgment are necessary, for upon what happens then, far more than upon the coffee as picked, depends the quality, the color and the commercial value of the coffee beans. During this stage the *administrador* is constantly called upon to decide how long this or that particular lot of coffee should be dried, and at exactly what moment it should be removed to the warehouse, awaiting its turn in going to the hullers. It is the drying stage, also, which has the most interest for the climatologist, for it is controlled at every point by meteorological conditions.

The drying-grounds are rectangular areas, square or oblong, varying a good deal in size, and numbering up to 16 or more on each fazenda. They are paved with Portland cement, square bricks or tiles, and usually have a gentle slope downhill, so that the water which carries the coffee may run off at the lower side, through iron

gratings, into small brick or cement-lined canals. Asphalt floors cannot be used, on account of their softening under the hot sun, and also because they give a taste to the coffee. Upon the separate divisions of these *terreiros* in the drying-season, one may see coffee in many stages of drying and of preparation. There is the coffee which, having been through the pulpers, has had most of the pulp and outer coverings removed, and is being dried before going to the hullers. There is coffee which went through the pulpers but which was not properly pulped, being too green, or too dry, or too small; this also is being dried, in order that outer covering and dried pulp and inner coverings may all be removed in the next stage. There is coffee which was too dry and too tough to go through the pulpers at all. There is coffee in all stages of drying. Each one of ten or a dozen separate divisions of the *terreiros* may contain a lot of coffee in a different stage of drying, and requiring different periods of drying. All this the *administrador,* or one of his immediate subordinates, has to look after, and it is just here that there is the greatest need of good judgment and of experience. When the *terreiros* are well filled, during harvest-time, they present an interesting scene, with many laborers constantly moving about, spreading out the coffee or gathering it up into heaps so that fermentation may take place; giving some more sun and some less sun; always under the watchful eye of the superintendent whose decision in each case is final. There can be no hard and fast rule about drying coffee; it is almost true that each wagon-load of coffee from the harvest requires separate treatment. In order to increase the temperature on the *terreiros,* the tiles are blackened, and under the noon sun and the cloudless skies which are characteristic of winter, the absorption of insolation is very great, and the heat, as one walks across the drying-grounds, is very intense. It was a constant source of wonder to the writer that the Italian laborers occupied in the drying of the coffee were able to walk with bare feet over these *terreiros.* The heat, and dryness, and glare were desert-like in their quality. The weather was simply ideal for drying: hot early afternoon hours, cool evenings and nights; low relative humidity; light wind, sufficient to promote active evaporation, yet not enough to blow the coffee about. No one can fully appreciate what outdoor drying means who has not been to the coffee country, and who has not himself experienced the weather conditions which prevail during the winter. During the writer's stay at the *fazendas* of Santa Veridiana and Santa Cruz the days were almost cloudless, with a light wind whose direction was evidently controlled by the topography, but which was in general easterly. The

early afternoon temperatures rose to 80° or a little over, with relative humidity between 45% and 50%. In the evening and early morning the thermometer read down to between 50° and 70°, with relative humidities of 70%-75%. On the *terreiros* themselves, in the early afternoon, the temperatures ranged from 2° to 5° higher than those above noted, and the relative humidities were between 40% and 45%. There was a striking absence of cumulus clouds, and it was noticeable that there was but a little inconvenience from perspiration. Both of these features are explained by the dryness of the air. The *administrador* of the Santa Veridiana *fazenda* told the writer, at the time of his visit in August, 1910, that the weather was wonderful for drying, and that no one could ask for anything better.

The duration of the drying-stage naturally varies very greatly: sometimes it lasts only a day or so; sometimes it takes several days, or even weeks. It all depends on the weather, and on the condition of the coffee, whether pulped or not, and whether already more or less dry as it comes in from the trees. Coffee in berry, *i. e.*, not pulped, takes much longer to dry. Rain, while not injurious to coffee on the *terreiros* which is still wet, is a serious injury to beans which are already nearly, or quite dry. Hence it is customary to have the coffee piled up at night at the center of each division of the *terreiro,* and covered over with canvas,* held down at the corners and edges with bricks. In São Paulo there is not much danger of any considerable damage from heavy rains in the winter months and the canvas coverings are usually quite sufficient protection.† Care is also needed to keep coffee which is in a critical stage of drying from excessive baking under the hot sun. It is an important part of the duty of the night watchman on a Brazilian coffee fazenda to keep watch of the weather, and in case of threatening rain, or of a high wind which might blow the coffee away, to summon the "colonists" to gather and cover up the beans.

The usual method of determining whether the coffee has been sufficiently dried to go to the hulling machines is to rub some of the beans hard between the palms of the two hands. If the two inner envelopes are removed by this friction, and are dry and brittle instead of tough, it is a sign that the beans are ready to be removed from the *terreiros.* Absolute dependence upon weather conditions, as happens in the open-air drying method, is often a long and always a more or less uncertain process. Therefore, just as we see, around

* Sometimes mats, or zinc covers, or bunches of long grass are used instead.

† In countries where heavy rains are expected, the coffee is sometimes kept out in trays or drawers, which are easily carried under cover or covered over. Other devices, such as metal roofs on wheels, which can be rolled out to the *terreiros,* are also sometimes used.

our large cities, more and more cultivation of garden truck under glass, where artificial heating, and watering, and protection against hail and heavy rains and frost, are easily provided, so the artificial drying of coffee seems likely to solve the difficulties of sun-drying. Artificial drying is the result of man's ingenuity in making himself more and more independent of the uncertainties of the weather. There are already several appliances for steam-drying coffee on the market, and it is likely that in time these will come into more and more general use, to supplement perhaps, rather than to replace, the open-air drying. At present, however, there is a strong feeling on the part of most of the *fazendeiros* that sun-drying gives better results: that the coffee dries more uniformly and has a better color and flavor.

With the further stages in the process of preparing coffee for market we are not here concerned, because the climatic control plays no further part in them. From the plantations, when ready for market, the coffee is shipped in bags weighing 60 kilograms each (132 lbs.) to Santos, where it is put into warehouses and then loaded on board steamers bound to all parts of the world.

HUDSON LAND

BY

EDWIN SWIFT BALCH

During the return voyage of the *Terra Nova* from McMurdo Sound, South Victoria Land, in February and March, 1911, an important geographical discovery was made which clears up one of the lacunas in our knowledge of the Antarctic Regions, namely, the position of the coast line of East Antarctica between the northwest extremity of Victoria Land and the eastern point of Wilkes Land.

This discovery by the British Antarctic expedition is announced in the *Geographical Journal,* for May, 1911, p. 569, in the following words:

"The ship afterwards cruised in the vicinity of the Balleny Islands, and, though much hampered by strong winds and foggy weather, discovered (February 22) a mountainous land in about 69° 50′ S., 163° 20′ E. It was seen again on February 25, and followed to 68° 30′ S., 158° 15′ E., but the heavy pack (in which the ship was caught for a time) did not permit an approach within 10 miles. The pack was finally cleared on March 8."

These two landfalls of the *Terra Nova* lie in an almost direct north-westerly line from the land sighted to the west of Cape North by Shackleton, to the most easterly part of the mainland of East Antarctica, Hudson Land, sighted by the United States Exploring Expedition in 1840. The importance for geography of this discovery lies in the fact that it unites Victoria Land to Wilkes Land and completes the outline of the coast of East Antarctica, from the Great Ice Barrier to Kaiser Wilhelm II. Land.

The most northerly of the *Terra Nova's* landfalls must be situated about 80 miles to the east and some 60 miles to the south of Hudson Land. Hudson Land was sighted to the southward by Lieutenant Charles Wilkes, U. S. N., on January 19, 1840, on the U. S. S. *Vincennes,* from a position in 154° 30′ E. long., 66° 20′ S. lat.; and on the same day by Lieutenant William L. Hudson, U. S. N., on the U. S. S. *Peacock,* from a position in 153° 40′ E. long., 66° 31′ S. lat. It was charted by Wilkes as Cape Hudson, but it is evidently a coast, and must be known and charted for the future as Hudson Land. How far Hudson Land lies south of the Antarctic Circle is, of course, still uncertain. Passed Midshipman Eld said he thought it was about 40 miles distant,* which would place it in about 67° S. lat., but it may easily have been farther, for distances in the Antarctic are almost always underestimated. It will probably turn out to be in about 67° 30′ S. lat.

To American geographers the paramount interest of the *Terra Nova's* discoveries lies in the fact that they make certain the existence of Hudson Land. For the lay of the *Terra Nova's* coasts as well as the lay of the coasts west of Hudson Land distinctly prove that Hudson Land cannot be far from its charted position. Moreover, since the accuracy of the observations of the American officers have also been proved in two other places by other expeditions, by D'Urville and Drygalski, we may feel confident that their other observations are equally trustworthy, and that they sighted Emmons Land, Case Land, Alden Land, North Land, Totten Land, Budd Land, and Knox Land, as well as Hudson Land, Adélie Land, Carr Land, and Termination Land. And furthermore, the new evidence which little by little each successive expedition to East Antarctica has added to what was discovered there by the United States Exploring Expedition, totals up more and more to prove that the great land lying between and including Hudson Land and Termination Land rightfully bears the name of Wilkes Land.

* Edwin Swift Balch: *Antarctica*, p. 149.

GEOGRAPHICAL RECORD

AMERICA

STUDY OF SHORELINE CHANGES ALONG THE ATLANTIC COAST. Prof. D. W. Johnson of Harvard, and assistants, is making a study of shoreline changes along the Atlantic Coast this year. The most important localities from the Bay of Fundy to Southern Florida will be examined during the spring and early summer. Special attention will be given to changes in the form of beaches within recent geological time and to supposed evidences of recent coastal subsidence. As the problem of coastal subsidence is affected by the relative heights of high tides on the outer and inner sides of barrier beaches, lines of levels will be run between the ocean and lagoons upon which tidal observations will be based. During the latter part of the summer, Prof. Johnson will visit places on the coast of England, Holland and Sweden to make comparisons with similar localities on the Atlantic coast of North America. The work will be the second Shaler Memorial Research supported by the Shaler Memorial Fund of Harvard University.

A GREAT ARC OF PRIMARY TRIANGULATION (TEXAS-CALIFORNIA). The Coast and Geodetic Survey has just completed a great arc of primary triangulation more than 1,200 miles in length, extending from central Texas to the Pacific coast. It connects the 98th meridian primary triangulation in the vicinity of Weatherford, Texas, with the Pacific coast primary triangulation in the vicinity of San Diego, Cal.

It is connected with the United States and Mexican boundary at a number of places and is joined to and correlates a number of detached government surveys. It furnishes the geographic positions on the U. S. Standard Datum, of more than 200 points which can be used to control all future public surveys within the region traversed.

There are 92 primary stations in the main scheme of this triangulation and, in addition, 38 stations in secondary schemes which provide for the connections with United States-Mexican boundary monuments and existing triangulation. The total area covered by the triangulation is 48,400 square miles, the average length of line east of El Paso is 17 miles, and from that place to the Pacific coast it is 62 miles. The maximum length of line is about 120 miles. The observations were made with a 12-inch theodolite, the pointings being made on heliotropes and acetylene lamps mounted at the stations observed upon. During the progress of the triangulation two primary bases were measured and 24 primary azimuths were observed.

The reconnaissance for this work was made between September, 1907, and February, 1908, and the observing was done in three seasons between November, 1908, and February, 1911. The total work was done in less than three years and six months, and the observations in less than two years and four months.

While the Coast and Geodetic Survey has, in the past, made more rapid progress on primary triangulation in the United States than that made in any other country, yet the rate of progress on the Texas-California arc exceeds that

on any other arc in this country and the unit costs per square mile of area covered by the main scheme and per mile of progress are only about one half those of the triangulation between Marysville, Cal., and Tacoma, Wash., the arc for which, previously, these unit costs were the lowest. The accuracy, as measured by the closing errors of triangles of the Texas-California arc, is greater than that specified in the requirements for such work.

The remarkable rapidity of progress and the low cost of the work were largely due to the small amount of camp equipage used by each unit of the party; to the fact that only two officers had charge of field work, Mr. William Bowie, Inspector of Geodetic Work in the Coast and Geodetic Survey, on reconnaissance and a portion of the first season's observing, and Mr. J. S. Hill on the remainder of that season's work and that of the succeeding two seasons; and to the services of a most efficient signalman, Mr. J. S. Bilby, who was attached to each party from the beginning of the reconnaissance to the end of the observing. The parties were organized and managed, in the main, in a manner similar to that of the parties engaged on other pieces of primary triangulation done by this survey in recent years, only such changes being made as were necessary to meet new conditions which were encountered in semi-arid and arid sections, much of which was also mountainous.

This arc of primary triangulation will not necessarily be discussed separately by this survey in investigations of the figure of the earth, as were the two great arcs, one extending across the continent along the 39th parallel of latitude and the other paralleling the Atlantic coast from Maine to the Gulf, and known, respectively, as the "transcontinental arc" and the "oblique arc." In the last two publications by the Coast and Geodetic Survey on investigations of the figure of the earth (entitled, "The Figure of the Earth and Isostasy from Measurements in the United States" and "A Supplementary Investigation in 1909 of the Figure of the Earth and Isostasy") the method was adopted of using the entire connected network of triangulation.—(WILLIAM BOWIE, in *Science*, April 7, 1911.)

GLACIAL STUDIES IN ALASKA. The Research Committee of the National Geographic Society of Washington has made an appropriation of $5,000 for continuing the glacier studies of the two previous years in Alaska. The work, beginning in June, 1911, will be done by Professor R. S. Tarr of Cornell University and Professor Lawrence Martin of the University of Wisconsin, who directed the National Geographic Society's Alaskan Expeditions of 1909 and 1910, in the Yakutat Bay, Prince William Sound, and lower Copper River regions. The 1911 expedition will study briefly a number of regions of glaciers not previously investigated by that Society, although partially mapped by the Alaska Division of the U. S. Geological Survey, the Boundary Commissions, etc. Work will be done on the present ice tongues and the results of glaciation in the mountains and plateaus of parts of the interior and some of the fiords of southeastern Alaska, the former having lighter rainfall and smaller ice tongues than the Yakutat Bay and Prince William Sound regions.

RAINFALL OF PORTO RICO. The *"Average Annual Rainfall of Porto Rico, W. I.,"* is the subject of a paper by Dr. Oliver L. Fassig, in the November (1909) number of the *Monthly Weather Review*. This is a preliminary report, a complete discussion of the climate of Porto Rico being promised in the future. The geographical distribution of the rainfall is shown by seasonal and annual charts. For the whole island the mean annual is 77 inches; varying from 37

inches along the south coast—an area devoted largely to the cultivation of sugar cane—to a maximum of 136 inches on the eastern slope of the Luquillo Mts. in the northeast portion of the island. From this area of heavy precipitation a number of streams flow down, to water the coffee and sugar plantations of the surrounding country. Along the north coast, where the citrus fruits and pineapples grow, the average fall is about 65 inches. The rainfall on the north side of the island is greater in amount, and more advantageously distributed throughout the year, than that on the south side. On the latter, periods of four or five weeks with little or no rain are of frequent occurrence, and periods of two or three months with less than an inch of rain are not uncommon. Irrigation works are now being planned in this southern area. At present, it costs planters from $25 to $50 an acre per year to pump ground-water for irrigating their cane fields. There are no well-defined wet and dry seasons. The winter rains are comparatively light, with a mimimum in February. There is a steady increase in rainfall from February through May. October gives the maximum for the island as a whole. For the island as a whole, autumn has 26 inches; summer, 23 inches; spring, 16 inches; winter, 11 inches. R. DEC. WARD.

A SMALL HANGING VALLEY. In view of the many recent discussions in regard to hanging valleys, the accompanying photograph may be of interest. It shows a very interesting, though miniature, hanging valley developed along a

small stream at the time of the draining of an old mill pond. The picture was taken along Cobb's Creek between Bryn Mawr and Philadelphia in late spring. During the winter or spring the old dam forming the pond had broken away and, when first seen, the stream had cut its way down to grade through the eight or ten feet of silt which filled the pond. The stump shown in the foreground of the picture was laid bare by stream erosion after having been long

buried under the covering of silt. It undoubtedly represents a tree that had been growing on the floodplain of the stream before the time of the building of the dam, possibly 75 or 100 years ago.

The small entering side stream shown in the center of the picture has been unable to cut down its valley to the level of the master stream and thus enters the main stream over a waterfall about 18 inches high. The hanging valley thus formed above the fall is open,—a wide U-shaped trough. The crest of this fall seems to be determined by a slightly more resistant layer of clayey silt. The tributary stream, though small, is constant in its flow,—not simply a wet weather rivulet. Developed on a small scale and in unconsolidated material and in the course of normal stream erosion, this hanging valley nevertheless strikingly resembles many of the large ones, even those developed by glaciation, which have come under the observation of the writer.

G. B. Roorbach,
University of Pennsylvania.

ASIA

Dr. Stein's Maps. Besides the vast store of archæological information which Dr. Aurel Stein brought back from Chinese Turkestan and Western Kansu, he and his assistants from the Survey of India carried out a very large amount of careful topographical surveying, which very greatly improves the maps of that region. Plane table surveys were carried on continuously during the journeys, and these were controlled by astronomical observations for latitude made at 72 stations, and by others made during a previous journey in 1900-1. From this material ninety-four sheets are being prepared by the Survey of India on the scale of 1:253,440, and will be published in the form of an atlas to accompany the detailed report on the scientific results of Dr. Stein's last journey. In the meantime reduced copies have been published by the Royal Geographical Society in the *Journal* for March. The whole area from Kashgar to Kan-Chou (Long. 75°-101°), including the Takla Makan desert and the mountains bounding it, is plotted on the scale of 1:3,000,000. Other maps on the scale of 1:1,000,000 show the Kun-Lun range on the frontier of Kashmir, and Western and Central Nan-Shan to the eastward. On all these maps, heights which have been determined by triangulation, or by barometric or clinometric observations, are shown, names have been carefully revised, and the areas occupied by cultivation, scrub or jungle, and desert have been distinguished. The whole forms a most valuable addition to Asiatic cartography. (*Nature*, April 20, 1911.)

EUROPE

Completion of the Map of the German Empire in 1:100,000. In view of the long existence and accurate topographic surveys in Germany it was somewhat surprising to learn (*Geogr. Zeitschr.*, Feb., 1911, pp. 102-104) that the standard topographic map of the country, which bears the above title, was completed only last year. This is due to the fact that prior to the foundation of the Empire no map existed representing the entire country on the same scale. In 1878 the topographic survey bureaus of Prussia, Bavaria, Saxony and Württemberg drew up an agreement whereby the preparation of the map was apportioned among them according to the respective size of the territories under their military jurisdiction. Of the total number of 675 sheets, each measuring 30′ in longitude and 15′ in latitude, Prussia thus undertook to complete 545, Bavaria 80, Saxony 30 and Württemberg 20. When the great amount of detail

and the painstaking execution of the map are taken into consideration, together with the fact that some original and continual revisional surveys have been necessary for its preparation, the time elapsed does not seem unduly long.

The map is too well known among students of the standard topographic maps of the world to require comment. It may be of interest to note, however, that before its completion a new edition, in three colors, on the scale of 1:200,000 has been begun on which relief is represented by contours in brown, resulting in a map far more legible and pleasing than the original, printed in one color, with its hachures in black.

STUDENTS' GEOGRAPHICAL ASSOCIATION. In January an association of the students of geography at the University of Leipzig was founded with the object of promoting interest in geography among the students in general and of aiding in their work students of geography in particular. Papers are presented on geographic topics, followed by discussions, and excursions and informal gatherings bring the members into closer contact with each other. (*Geogr. Zeitschr.*, Feb., 1911.)

POLAR

DR. NANSEN EXPLAINS AMUNDSEN'S ADVENT IN THE ANTARCTIC. Much surprise was expressed when it was announced that Capt. Amundsen, instead of carrying out his plan of going to the Arctic Ocean through Bering Strait for a five years' drift across the polar area, had decided to enter the Antarctic field. His change of plan is now explained by a letter from Dr. Nansen, published in the London *Times* (weekly edition, April 28, 1911), in which he includes the long letter that Amundsen sent to him from Madeira.

It appears that when news arrived in the autumn of 1909 of the journeys of Cook and Peary in the Arctic regions, Amundsen felt certain that he would not be able to raise all the money required for his Arctic project. This conclusion was later justified by events, for he found himself unable to obtain the balance of the money, about $40,000, which he needed for the long Arctic enterprise he was contemplating. He saw that he would have to change his plans and he decided to go to the Antarctic and to attempt to reach the South Pole, which, he believed, was the only phase of exploration left to him that might reawaken public interest and bring him the money he needed. He did not tell his plan to Nansen or other friends, fearing that they would try to dissuade him. He thought himself sufficiently equipped, however, to make a dash for the South Pole, and he announced his change of plan in his letter to Nansen from Madeira.

Dr. Nansen calls attention to the fact that the bases of operations of Scott and Amundsen lie far apart, there being about the same distance between them as between Spitzbergen and Franz Josef Land. Nansen concludes:

"It is beyond doubt that such an excellent explorer as Capt. Scott, with his carefully equipped expedition, will return with results of very high scientific value; but, on the other hand, Capt. Amundsen, by journeying through another region, will most certainly bring back valuable information of unknown tracts quite independent of Scott. I therefore think that students of polar problems have great reason to rejoice that two such eminent explorers are at work simultaneously in the south, as their discoveries and observations will supplement each other and the value of each will thus be greatly increased."

AN EXPEDITION TO JAN MAYEN. The Society is informed that Mr. J. Foster Stackhouse of England has organized an expedition to visit, in the coming

summer, Jan Mayen, northeast of Iceland in the Greenland Sea. The purpose is to chart the waters around the island and to make observations on land. Mr. W. S. C. Russell, Director of the Science Department of the Central High School, Springfield, Mass., has been invited to take the geological work in charge. His purpose is to make a study of the glaciers and ascertain the present condition of the two volcanoes Esk and Beerenberg. He will sail from Boston on June 23, to join the English party at Newcastle. Other members of the expedition will be an ornithologist from Sweden, an oceanographer who was with Scott in the Antarctic and Baron Klinckowström, of Stockholm, who was on the Belgica relief expedition and has done good work in Spitzbergen. The party expects to call at the little island of Mevenlint, almost unknown on the charts, and run a line of soundings around it.

EDUCATIONAL GEOGRAPHY

MAP STUDY IN SCHOOLS. The study of the map and its practical use should receive greater emphasis. The interpretation of geographic relations from a clear wall map will yield results that few teachers appreciate. Pupils should acquire the knack of rapidly sketching memory maps which illustrate certain definite features. No time should be given to the tracing of the detailed features of an irregular shoreline nor devoted to outlining a continent by an elaborate system of longitude and latitude. Blank maps for each pupil are essential in the distribution and progressive studies of climate, surface and commercial relations. Large blank wall maps are valuable in the class discussion of the resources, relief, drainage and any data that the teacher can readily plot thereon. Elementary geography in this country needs wall maps, charts and diagrams that are simple and clear in their delineated features and adapted to the capacity of the pupil. The American Geographical Society has given a distinct service to education in its traveling exhibit of foreign maps, and there remains a similar duty in a compilation of the Amercan published maps accompanied by a statement of merits, defects and details of price, publisher, mounting, editions, etc.

The places to locate are more numerous now, but some phases of modern geography are of greater value to the child than mere mechanical location exercises. The plea, for such mnemonic work, indicates a serious neglect of the atlas and the map in the elementary school and a disregard of their habitual use. Why not be as sensible in the use of the map and the atlas as the dictionary? Let the teacher realize that work is half done when the history and the reading classes are conducted without the use of the map.

The necessity of illustrative material in geography is widely recognized by educational authorities. The modern texts have a generous assortment of pictures and maps, but the school equipment of globes, wall maps, charts, pictures, specimens, products and lantern slides is extremely scant in the elementary schools of the large cities. In one large city the cost of the geographical equipment in a single high school exceeds the total value of all the maps and the materials for the teaching of geography in one hundred elementary school buildings.—From "Present Problems in Elementary School Geography," by W. M. Gregory, *Journ. of Geogr.*, Vol. IX, No. 7, 1911.

INSTRUCTION IN METEOROLOGY. The last ten years have brought a very marked advance, and also a most effective improvement, in meteorological instruction in our schools and colleges. Anyone who will take the pains to

compare the geographical texts of a dozen or so years ago with the more recent volumes can easily convince himself of this fact. This is a most encouraging sign, for there are few studies which are better adapted for training in habits of system, accuracy and punctuality, and not one which contributes more, in the long run, to make daily life interesting. The atmosphere we cannot escape from. The physical experiments—for they are obviously physical experiments on a large scale—which go on in the atmosphere, are constantly brought to our notice. We cannot, if we would, fail to have our attention drawn daily, almost hourly, to the weather phenomena which, in a fairly regular yet never monotonous succession, are constantly recurring.

The text-book,"Manual of Physical Geography," by Dr. F. V. Emerson, of the University of Missouri (reviewed in Bulletin, Vol. 42, 1910, pp. 299-300), gives about 40 pages to a few well-chosen exercises on meteorology and climate. These, it is to be noted, are placed very near the beginning of the book, where they properly belong, instead of being tucked away as if they were an afterthought, in a less conspicuous place. The exercises cover insolation, a subject which, we agree with the author in thinking, is generally neglected, but of fundamental importance; annual and diurnal march of temperature; the effect of oceans and continents and of altitude upon temperature; relative humidity, and its hourly and monthly variations; rainfall; studies of cyclones and anticyclones; and miscellaneous climatic phenomena, such as land and sea breezes, chinook winds, dew, fog, clouds, frost, sailing routes, etc. Clearly, the number of topics here touched upon is so large that only a very brief study can be made of most of them. Nevertheless, the teacher who takes an interest in this side of geography can extend the work along the suggested lines, and by so doing will be able to frame a consistent and satisfactory course of instruction.

R. DeC. Ward.

Geographical Equipment of the Cleveland Normal School. The Department of Geography in the Normal School, Cleveland, Ohio, is designed to provide convenient facilities for the training of students to teach elementary school geography. The rooms devoted to this subject are on the second floor of the new building which is located south of University Circle and fronts to the east on Ambler Park.

The space given to geography is divided into a lecture room, laboratory, exhibit room, office, storage room and a small dark room. The lecture room has a raised platform upon which there is a demonstration desk with ample space for the class display of experiments, pictures, materials, etc. The projection apparatus and lantern slide cabinet is placed at one side of the demonstration desk and so arranged that it may easily be operated by the instructor. A blank wall space to the front and side of the room serves for the projection surface. The lecture room has blackboard space and two sliding map racks for the display of wall maps and charts.

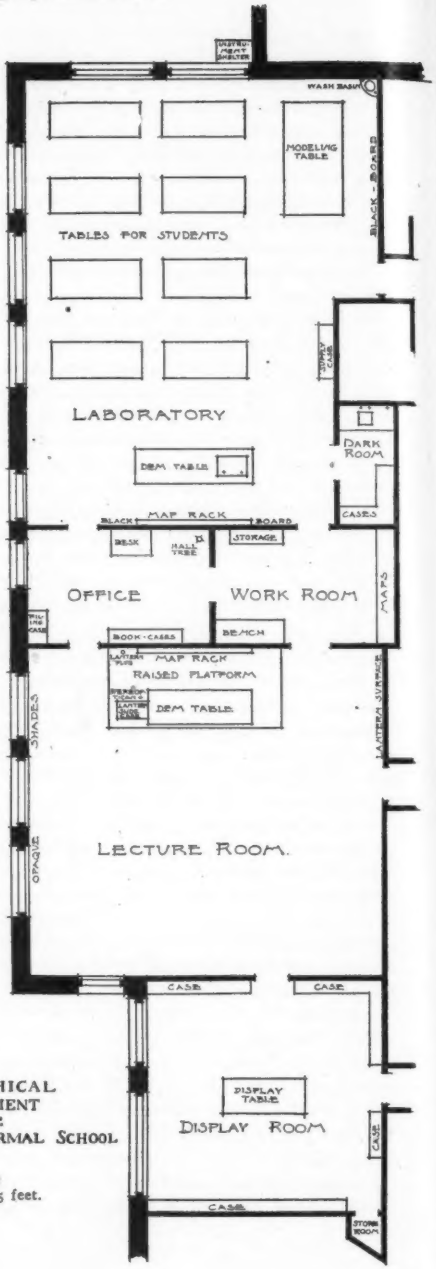
The laboratory is a large well lighted room which has been arranged for the first hand study of various geographical materials and affords an opportunity for the student to prepare simple and effective teaching devices, i. e., charts, produce maps, modeling materials, local plans, outline maps, diagrams, collections of raw materials and pictures. At the front of the room is a large demonstration table provided with gas, water and numerous storage drawers. The eight large work tables have individual lockers and accommodate four students each. The tables are flat topped and are fitted with detachable map

racks. Large sliding map racks at the front of the room supply display space for maps, charts and diagrams. A lead lined modeling table, fitted with storage bins for clay, sand and shelves for modeling boards, occupies one corner of the laboratory. There is an exposure shelter for meteorological instruments.

The small exhibit room is designed to display geographical materials and objects for inspection and study by students. The side walls of this room are fitted with display cases which have slanting shelves. In the center of the room is a special exhibit case with plate glass top and fitted with four tiers of interchangeable drawers which serve for the storage and display of material.

The storage room has a map case with the upper three compartments for rolled maps, while the lower four cupboards and three drawers are for flat maps, charts and supplies. In the storage room there is an additional case for supplies and a small work bench. The dark room is provided with gas, electricity and water on the developing bench and wall cases for materials. The office which is between the lecture room and the laboratory is provided with desk, filing cases and ample book cases for a departmental library.

W. M. GREGORY,
Cleveland, Ohio.



GEOGRAPHICAL
DEPARTMENT
OF THE
CLEVELAND NORMAL SCHOOL

Scale
1 inch = 15 feet.

GEOGRAPHICAL LITERATURE AND MAPS

(INCLUDING ACCESSIONS TO THE LIBRARY)

BOOK REVIEWS AND NOTICES

AMERICA

Annual Report of the Topographical Surveys Branch, Dept. of the Interior, 1909–1910. v and 162 pp.. 19 illustrations and, in separate pocket, 10 maps and 8 profiles. Ottawa, 1911.

This *Report* of the Canadian government bureau corresponding to our General Land Office, which covers the year ended March 31st, 1910, contains the usual summary of the year's work by the Surveyor General (pp. 1-19) and extracts from the individual reports of the Dominion Land Surveyors. Beginning with this volume the description of the townships subdivided during the year will be omitted, as they are of little general interest. They will be printed separately for land seekers and intending settlers. The individual reports include:

Measurement of Kootenay Base Line by P. A. Carson (pp. 53-70). This base line, over five miles long, measured with an invar apparatus, was laid out in the Columbia Valley, about twenty-five miles S.E. of Golden on the Canadian Pacific Ry. It controls the complete network of the triangulation survey in the Railway Belt of British Columbia, from the summit of the main range of the Rocky Mountains westward to the Coast Range.

A. H. Hawkins (*Report*, pp. 84-91) throws much new light on the country at the head of the Smoky and Simonette Rivers along the eastern flank of the Rockies in 54° N. and suggests the reservation of this tract as a national park and game reserve.

J. N. Wallace's survey (pp. 148-154) of a part of the Fourth Meridian (110° W.) led to the delineation of a lake not hitherto shown on any map, Primrose Lake, in 54¾° N., extending forty miles in a S.W.-N.E. direction.

The information in the *Reports* of the Topographical Surveys Branch is in the nature of raw material and requires correlating to become of general value. This is a task which amply repays any tediousness it may involve because of the wealth of new data the reports contain as to the topographic features and natural resources of large tracts of territory which, in many cases, are practically unexplored. W. L. G. J.

A Descriptive Sketch of the Geology, and Economic Minerals of Canada. By G. A. Young. With an Introduction by R. W. Brock. Geological Survey of Canada, Pub. No. 1085. 151 pp., 82 illustrations, 2 maps. Ottawa, 1909.

Synthetic works are fundamental because they give a general survey of their field, correlate its facts and thereby present them in their true perspective. It is highly encouraging that the official survey organizations, both national and

state, or provincial, of Canada, the United States and Mexico, include among their publications works of a general character, for the trained investigators in the field, although growing in number, are still too few to make adequate use of the quantity of admirable material of a detailed nature which the various surveys are producing. Synthetic works are, therefore, always welcome. Such a work is the one under discussion.

Although written with a view to supplying the general information contained in such outlines as Dawson's sketch of the physical geography of Canada in the Handbook of Canada, prepared at the time of the Toronto meeting of the British Association for the Advancement of Science or the earlier Physical Geography of Canada by Selwyn and Dawson, both of which are now out of print and not always readily accessible, it does not pretend to supplant them, nor is its scope quite the same.

In the introduction R. W. Brock, the Director of the Survey, not unreasonably predicts a promising future for the mining industries of Canada, arguing by the analogy of conditions in the better known, although still far from thoroughly explored, southern parts of the geological provinces of the Dominion, with those in their practically unexplored northern portions.

The main part of the work, by G. A. Young, is divided according to the natural regions of Canada. Of each region a general characterization is first given, followed by its geologic history and a description of its economic minerals. A chapter on the Glacial Period in Canada forms the conclusion.

As the natural region is the unit of geographic investigation a short summary of the divisions used in the work, which, although not original, constitute its principal claim to geographic value, may not be out of place.

The natural divisions established, which are not necessarily included in their entirety within the domain of the Dominion, are: (1) The Appalachian Region, (2) the St. Lawrence Lowlands, (3) The Laurentian Plateau Region, (4) the Arctic Archipelago, (5) the Interior Continental Plain, (6) the Cordilleran Region.

The western boundary of Canada's portion of the Appalachian region is the St. Lawrence Valley up to Quebec and thence the St. Lawrence-Champlain fault extending S.W. to the foot of Lake Champlain.

The Canadian share of the St. Lawrence Lowlands, bounded on the north by the southern edge of the Laurentian Plateau, is divided into three subdivisions by the low spur of the Laurentian Plateau which crosses the St. Lawrence and forms the Thousand Islands, and by the Niagara Escarpment, which enters Canada at the Niagara Peninsula and extends thence northwest through the Indian Peninsula, separating Lake Huron and Georgian Bay, and is continued in the Manitoulin Islands.

The Laurentian Plateau is Suess's "Canadian Shield," the U-shaped nucleus surrounding Hudson Bay and bounded on its outer convex side by the great chain of lakes from Great Bear to Huron and by the St. Lawrence depression.

The Arctic Archipelago defines itself. Its eastern members are a continuation of the eastern rim of the Pre-Cambrian formations of the Laurentian Plateau, its western members are mainly Paleozoic.

The Interior Continental Plain is included between the Laurentian Plateau and the Cordilleran Region. Its subdivisions are mainly vegetational: a southern, or prairie, and a northern, or wooded section, merging in about 54° N. It terminates to the north at Great Bear Lake beyond which the tundra extends.

Its southern prairie portion is divided into three levels by two lines of escarpment trending N.W.-S.E., the Manitoba Escarpment and the Missouri Coteau.

Canada's portion of the bi-continental highland, the Cordilleran Region, is subdivided into three longitudinal divisions, two mountain systems on its borders enclosing an irregular plateau region. The eastern mountain system includes the Rocky Mountains and, N. of the Liard River, the Mackenzie Mountains; the western system, the Coast Range. The central plateau region is separated transversely by a broken, elevated belt of land dividing the Yukon and Liard River systems. The two portions of the plateau thus isolated are known as the Interior Plateau of British Columbia, in the south, and the Yukon Plateau, in the north.

For further details the reader must be referred to the work itself. The numerous illustrations are well chosen, being typical of the regions they represent. The two valuable maps, one of the geology and one of the distribution of the mineral deposits, were listed in the May *Bulletin* (p. 390). W. L. G. J.

The Buccaneers in the West Indies in the XVIIth Century. By C. H. Haring. viii and 298 pp., bibliography, index, 10 maps and illustrations. E. P. Dutton & Company, New York, 1910. $3.50.

Although the annual fair formerly held at Porto Bello on the Isthmus of Panama was open at most for forty days and sometimes for only ten or twelve, the volume of business transacted was estimated at the beginning of the eighteenth century to amount to $200,000,000. Let us consider this fact in connection with the circumstance that Morgan had proved that neither Porto Bello nor Panama could withstand the buccaneers. Between 1655 and 1671 alone the corsairs sacked eighteen cities (Porto Bello once, Panama once, other cities repeatedly) and plundered and destroyed about forty Spanish-American villages and towns. Mr. Haring quotes an estimate made in 1685 to the effect that the losses of the Spaniards at the hands of the buccaneers "since the accession of Charles II" amounted to 60,000,000 crowns, and those figures did not include the loss of more than 250 merchant ships and frigates. Again, in 1697 Cartagena was captured by a force which was partly composed of buccaneers, the plunder in this case being valued at $100,000,000. Evidently the field for the exercise of the talents of those freebooters who chose the Spanish Main as the scene of their exploits was richer and wider than ever at the close of the seventeenth century. Why, then, does their history end with the raid on Cartagena?

Mr. Haring answers that Spain's American possessions were at that time actually much more profitable to the other European nations than to the Spaniards themselves; that it was the English, the French, and the Dutch traders who carried their merchandise to Spanish ports and freighted the Spanish-American fleets, and who appropriated the greater part of the gold, silver, and precious stuffs which the Spanish fleets brought back from Porto Bello and Vera Cruz. Therefore the capture of a Spanish galleon or the destruction of a Spanish-American town came to be regarded as a blow directed less at the Spaniards than at the foreign merchants who were interested in the trade between Spain and her colonies. Naturally the English and French governments abandoned the old policy of connivance and encouragement, adopting instead severe measures for the suppression of buccaneering, "because they came to

realize that it was easier and more profitable to absorb the trade and riches of Spanish-America through the peaceful agencies of treaty and concession than by endeavoring to enforce a trade in the old-fashioned way inaugurated by Drake and his Elizabethan contemporaries." The author's very sensible view of this matter fairly indicates the character of his book, every chapter of which may be read with pleasure and profit. There are chapters on the Spanish colonial system, the freebooters of the sixteenth century, the beginnings of the buccaneers, the conquest of Jamaica, Tortuga, Porto Bello and Panama, the suppression of the buccaneers by the government, and the lapse of buccaneering into mere piracy. M. W.

An Unknown People in an Unknown Land. An Account of the Life and Customs of the Lengua Indians of the Paraguayan Chaco, with Adventures and Experiences met with during twenty years' pioneering and exploration amongst them. By W. Barbrooke Grubb. 330 pp., illustrations and map, appendices and index. J. B. Lippincott Company, Philadelphia, 1911. $3.50.

Vast levels of treeless grass-land interspersed with open palm groves or scrubby thickets, in rainy seasons a vast swamp with water everywhere though rarely open, in dry time a withered prairie, desolate and inhospitable, foodless but for the abundant lung-fish (*Lepidosiren*) buried in the mud beneath the baked surface, whence they are dug out by squalid Lengua Indians, clothed to the waist with a single garment, the women of skins, the men of a blanket—such is the Chaco in Paraguay. The Lengua is low in the arts, possesses almost nothing, has no permanent home, gorges himself when he happens on food, but is lazy and improvident lest his fellow profit by his labors. The law of his tribe would compel him to admit less energetic members to his house if he made it larger or drier, so he makes but a wind-break of branches. As surplus of corn or other food would be at once property of his companions he produces only for merest necessity.

Among these men, hostile and suspicious of foreigners, W. Barbrooke Grubb thrust himself some twenty years back, unwelcome, but resolute to win their confidence. Early chapters seem to make capital of the hardship and danger of the attempt. There is no need. It was a man's task well done. For years alone, he mastered their language and their habits, won their confidence and their liking, and the picture he paints of their ways and thoughts impress us with the nearness of his approach to that strange, shy creature, primitive man. He believes they have degenerated from a previous, higher state, coming perhaps from the Andes. The socialistic law that forbids individual ownership has been imposed on them, like their habit of infanticide, by the harsh conditions of their wanderings through the forest. Progress was begun by the Mission in improving their condition when this socialism was destroyed (all unconscious Mr. Grubb, the while, that the irony of circumstances is bringing another band of white socialists a quarter way round the world from Australia to try out the community-of-goods idea only 500 miles away—and fail,—in the colonies Nueva Australia and Cosme).

The Mission has fixed the Indians in permanent homes, has checked infanticide, is teaching industry and thrift. It is an accomplishment and Grubb's part an amazing contribution to human endurance and steadfastness and to knowledge. The book is good reading, but the reader will not wish to emigrate to the Paraguayan Chaco. MARK JEFFERSON.

The Great States of South America. A Concise Account of their Condition and Resources, with the Laws relating to Government Concessions. By Charles W. Domville-Fife, Author of "Submarines of the World's Navies," "The United States of Brazil," etc. xv and 235 pp., index, 72 illustrations, 8 maps. G. Bell and Sons, Ltd., London; The Macmillan Company, New York, 1910. $4.50.

The author says that British capital invested in South America amounts approximately to the sum of £500,000,000, not including the private investments of individuals. When we consider British investments in the central portions of Latin America as well, $1,000,000,000 must be added, since he asserts that it is the £700,000,000 from England and her dominions beyond the seas which have financed the countries of South and Central America; and there is exultation in his words: "So strong has England's position in South America become that these countries now look to her whenever they require financial help or counsel; and when they receive it, as has hitherto nearly always been the case, they are willing to give much in return. . . Their warships, railways, waterworks, tramways, and all other public services are the highly satisfactory results of capital supplied from the vast store of the United Kingdom."

The South American countries described are Argentina, Brazil, Chile, Peru, Paraguay, and Uruguay; and the author has included the Central American state of Guatemala in the list. The work, published under the authority of the Consuls-General of the countries just enumerated, has been revised by diplomatic and consular representatives in Great Britain. Furthermore the author has too readily accepted as authoritative and reliable the official statistics and other advertising matter furnished by the governments of the countries treated. It is scarcely necessary to add that extremely favorable views of many doubtful subjects are concisely presented. The design certainly was not to render less attractive to capitalists and immigrants of the better class such accounts as are given of the laws, regulations and conditions relating to government concessions. These eight Latin American republics are represented as being blest with stable governments, and armies, navies, and police forces that can be relied upon in the event of either internal or external troubles or emergencies. The vast field is not only full of promise but already is most important, according to Mr. Domville-Fife. M. W.

AFRICA

With Mulai Hafid at Fez. Behind the Scenes in Morocco. By Lawrence Harris, F.R.G.S. xvi and 270 pp., and illustrations. Richard G. Badger, The Gorham Press, Boston, 1910.

This book is an account of the interview of an English newspaper reporter with the Sultan of Morocco at Fez. The story covers a journey from Tangier to Fez, various audiences with Mulai Hafid, the extreme dangers of travel and life in the country, the excessive cruelty of punishments and glimpses, now and again, into the degraded lives and weak character of the people. The narrative teems with rehearsals of cruelty and squalor. The testimony of the book bears out the charges of brutality, corruption, tyranny and chicanery which are so freely made against this government and people. With such a distressing picture one may rejoice that most of Africa has been improved under the influence of the strife for land of European powers. R. M. Brown.

Nigerian Studies; or, The Religious and Political System of the Yoruba. By R. E. Dennett. xv and 232 pp., map, illustrations, and addendum. Macmillan & Co., Ltd., London, 1910. $2.75.

This book is a collection of notes on the religious and political system of the Yoruba, a once powerful negro people now much reduced and included in the sphere of British influence. The book opens with a brief account of the history of Yoruba Land. In the second chapter is a story of creation as told by an old priestess and a description of the sacred stones which are supposed to be the metamorphosed gods of the creation. The third chapter describes the death and burial customs. Ancestral worship forms a large part of the Yoruba religion and the beatification of the forbears of the people, so prevalent to-day, is a very old custom. The remainder of the book explains the social and religious systems as they appear in the occupations of fishing, hunting and in the marriage laws. The signs or omens of the fishermen have their counterparts in the superstitions of many races and are not unknown even among the more advanced races. The life of the hunter forms an interesting chapter which includes a conception of justice based on fatalism and an example of red-tape in the regulation of elephant hunting. The work can be recommended to any one interested in the development of savage races or in the stages of religious and philosophic thought. A number of illustrations and a good map are included in the volume.

R. M. Brown.

ASIA

China Under the Empress Dowager. Being the History of the Life and Times of Tzu Hsi. Compiled from State Papers and the Private Diary of the Comptroller of her Household. By J. O. P. Bland and E. Backhouse. xv and 525 pp., illustrations and appendix. J. P. Lippincott Co., Philadelphia, 1910. $4.

Information concerning the throne of China has been so vague and conflicting that we have known little and judged inaccurately of the motives and acts of rulers at Peking. This book of the life of the late Empress Dowager who ruled almost continuously for fifty-five years will, to some extent, be illuminative. She began her career as an imperial concubine in 1852, and from the outset her tact and her ability to handle difficulties were displayed. She easily ingratiated herself with the then Empress Dowager, Tao-Kuang's widow; became the first favorite of the dissipated Emperor, Hsien-Feng, and provided him with an heir to the throne. When the Emperor's mother died and the Emperor himself had paid the penalty of a dissolute life by an early death, Tzu Hsi, with celerity and resolute purpose seized the throne for her infant son, T'ung-Chih, assumed the Regency and nominally shared it with the Empress Consort. The first Regency extended through twelve years (1861-1873). At the end of that period, the Regents handed the control of affairs over to the Emperor, who like his predecessor was dissipated and soon paid the penalty by "mounting the Dragon's chariot and proceeding on the long journey."

Again, the claims to the throne were set aside and Tzu Hsi assumed the Regency, appointing Kuang Hsu, an infant, Emperor. This Regency lasted fourteen years (1875-1889). During 1898, on the exposure of a plot against the throne, the Empress Dowager appointed herself Regent once more and, practically imprisoning the Emperor, ruled the Empire until her death in 1908.

Tzu Hsi's long period of rule in China was not altogether an accident if we

can read between the lines of the Memorials and Decrees. It was really a usurpation of the throne. The authors with no lack of humor remark that "it was clear (and there were many voices to reassure her of the fact) that the stars in their courses were looking for the continuance of her unfettered authority, and that any trifling assistance which she might have given them would not be too closely scrutinized." This trifling assistance, after the death of the father of her son, included the degradation of the Empress Consort, the death of her own son, the ostracism of the son's wife, the neglect of the unborn child, the appointment of the next Emperor (and the appointees were always infants who must have a regent), the death of Kuang-Hsu's wife, the imprisonment of Kuang-Hsu, probably his death, the death of the Empress Consort, not to mention the host of ministers and advisers who were beheaded or invited to commit suicide. The history of her times sheds new light on many problems which have puzzled the Occident, such as the suicide of Wu K'o-Tu, the reform of 1898, the *coup d'état* of 1898, the Boxer movement, the status of Li Hung Chang and the appointment of the present Emperor. The concluding chapter sums up the characteristics and life of this remarkable woman, who, although she broke many of the tenets of civilization from the western point of view, must be judged as one of the great women of history. R. M. Brown.

Palestine and its Transformation. By Ellsworth Huntington. xvii and 443 pp., map and illustrations, appendix and index. Houghton, Mifflin Company, Boston and New York, 1911. $2.

As is well known to readers of the *Bulletin*, the author has had seven years of Asia, but his trails in the Holy Land were all of the year 1909. He threaded the little land fairly in every direction; across Philistia, Judæa, over the Ghor to Moab, Gilead, Jebel Druze, Damascus, Palmyra; to Petra in the south, across the Ghor again south of the Dead Sea to the parched land of the Negeb as well as through Samaria, Galilee and the Lebanon. He has the art of travel and accepts all situations. "In the cool, invigorating air of the spring afternoon we rode to Hebron, highest and most flourishing of Judæan cities—a pretty place, set on a tongue at the junction of two valleys and looking down the main fertile valley." But equally, "arriving at Beni Na'im we found the village deserted, for all the inhabitants had removed to the harvest fields, as is their custom in summer. After sleeping in the streets, we resumed our way."

Of adventures there is rarely more than a hint. A "good fortune" lost them in the eastern wilderness of Judæa and sent them stumbling down the cliffs to grope about the reedy, mucky plain until 10 at night, when Jericho was reached. When a couple of Druzes cover him with their rifles, his companions get their revolvers ready, "but as I had none all I could do was to tell Abdullah to say 'go to, this is unseemly, better put up your guns or you'll get into trouble.'"

They struggle with head winds on the inhospitable east shore of the Dead Sea in their little canvas boat, only to have to draw it up on the rocks and find their food and water spoiled by the bitter waters that have washed in. The hardships of wandering off the beaten tracks in such lands are often hinted at but never enlarged upon.

Huntington found Palestine interesting, very, but not beautiful, save in the momentary delight of glimpsing the sown land on some return from the desert.

We are shown the reason for the exclusiveness of the Jew in the topographic isolation of his land, which is further traced to its roots in material and geologic structure. The contrast between Jew and Phœnician is an admirable sample

of the work. Both dwell on narrow highlands at the east end of the Mediterranean. One race, north of Carmel, has wrought out its history on a fragment of the earth's crust that had suffered gentle subsidence beneath the sea long before history began, so that it invaded every valley and made a coast of alternating bays and promontories with some sort of shelter for ships. The land itself was all rugged mountain and valley, nowhere lacking views of the sea on which the rough slopes descended, to which every gorge and valley opened, and beside which lay all the towns. The call of the sea resounded forever throughout Phœnicia and the people fared forth to know the world and mix with its peoples.

In this sinking of the Phœnician shore Carmel was a sort of hinge point. To the south the shore rose instead of sinking and put between Judea and the Mediterranean a fifteen-mile-wide strip of ancient sea floor, brought to light in the uplift, its edge straight, harborless and quickly cliffed by the waves, the more to part the Jew from the sea. East of this smoother belt, beyond the cuesta of the Shephelah, lies the flat-rock plateau of Judea, 3,000 feet above the sea, its border cut by the rushing rains into the deep, crooked defiles that are the only path from below. Thus the Jews lay aside from the life of the world effectively a race set apart.

"In Judæa . . . many a village and almost every hilltop brings with it a sense of space and of being at the top of everything. . . Scores of other villages give rise to the same feeling. Perhaps it is in part imagination but my companion felt likewise. It cannot be wholly imagination, for our host evidently loved the view: and few men are so dull that they fail to be thrilled with some slight stir of feeling when they stand looking down on all the world at sunset."

After the charming narrative and mingled with it comes Huntington's new presentation of his doctrine of Dry Epochs. Unusual drought in the desert drives its nomad inhabitants for very life to the agricultural border land. Then civilizations are overwhelmed by hungry swarms of desperate men. Of old, thousands of years ago, climates were wetter than now, and the change came not gradually but in sudden decades of acute drought, followed again by centuries of moister years. Two of these crises of aridity fell in 1200 B. C. and 700 A. D., two periods of chaos in history for lands neighboring the desert. "Three eras make up the tale of history. Three great pulsations the course of climates during the same period. The eras and the pulsations agree in time. The first era comprises the hazy past when Egypt and Babylonia were at their greatest. It ends with the chaos of the Aramæan migrations. The second spans the life of Israel in Palestine, the Greeks in their islands and peninsula, Italy in the most western of the great lands of antiquity and Assyria and Persia far to the east. It also ends in chaos with the migrations of the Barbarians and the Mohammedans."

The plea for this doctrine will not convince everyone, but Huntington's readers have not in the past needed to be convinced to enjoy his writing. This book leaves us ready for more. MARK JEFFERSON.

Persia in Revolution. With Notes of Travel in the Caucasus. By J. M. Hone and Page L. Dickinson. xiv and 218 pp., map and illustrations. T. Fisher Unwin, London, 1910. 2s. 6d.

Persia in Revolution is a brief and somewhat unsatisfactory account of a trip from Warsaw to Baku to Teheran, with an excursion into Trans-Caucasia.

The time is during the recent revolution in Persia and much attention is given to the relations of England and Russia to the political conditions of Persia.

Much is made of the difficulties of travel, more of the fantastical side of the revolution—some of which is not particularly clear or coherent—and the more interesting section of the volume is devoted to certain aspects of Persian life. Except in this latter section, the volume adds little of interest that is not generally known and has not been more fully described elsewhere in a more authoritative and appealing way. R. E. DODGE.

AUSTRALASIA AND POLYNESIA

Melanesians and Polynesians. Their Life-Histories Described and Compared. By George Brown, D.D. xv and 451 pp., illustrations, appendix and index. Macmillan & Co., Limited, London, 1910. $3.

The presence of a prior theory has availed to deform the arrangement of Dr. Brown's presentation of his material, but his honesty as a primary observer is so ingrained that the most minute and intimate scrutiny fails to disclose a single instance in which the prejudicial theory has marred the accuracy of his record of things which have come under his own eye. Dr. Brown's prejudice is that the black race and the brown race of the Pacific are one in source. The unity of the widely extended brown Polynesian race is well established and wholly accepted. We are forced to acknowledge, however, that we use the designation Melanesian only as a provisional and descriptive term; we have no evidence that the folk are single in race between New Caledonia and New Guinea, and there is good reason to suppose that the Melanesian name covers at least two black races and areas of intermixture of the two, the whole overlaid, as I have elsewhere shown at length, with later contamination of the migrant Polynesians. To adjust his observations to this theory of unity Dr. Brown has split each of his chapters by a warning dash into the Melanesian record and that derived from Polynesia. For each topic he qualifies as a competent witness. He served the missionary life in Samoa for fourteen years from 1860; in 1875, he was the first man to open to knowledge the Duke of York Group and adjacent coasts of New Britain and New Ireland; in 1879 he began his acquaintance with the Solomon Islands. His theory makes his book awkward, but it has had no discoloring effect upon the record of observation whether it come before or fall after the dash.

His Samoan notes have the advantage of a more unsophisticated society than is recorded in Krämer's great monograph; they are to be associated with Turner's study of that people, and they by turns corroborate, correct and supplement his former colleague. In the Melanesian section we find evidence that Dr. Brown has not made himself familiar with the recent work which has shed a bright light on the Gazelle Peninsula in Neu-Pommern (New Britain) and upon the black shore of Neu-Mecklenburg (New Ireland) facing Mioko at which he was so long stationed. We gain by this rather than suffer loss, for it affords a measure by which to compare his observation and to find it true. Ethnographers, therefore, may place full credence in this volume as an exact and independent record of Samoa, of the islands and littoral of St. George's Channel, of the Shortland Islands in the Solomon archipelago and of certain parts of the Louisiades and the adjacent shore of New Guinea. Students of the South Sea would have felt it a distinct loss if this venerable observer had neglected to publish this volume. WILLIAM CHURCHILL.

EUROPE

Le Var Supérieur. Étude de Géographie Physique. Par Jules Sion, Docteur ès lettres. xi and 96 pp., 8 illustrations, and bibliography with 72 entries. Armand Colin, Paris, 1909. Frs. 3.

The Var is a relatively small river draining the French slope of the Maritime Alps and emptying into the Mediterranean a few miles from Nice. After elucidating the structure of the district the author discusses the development of the upper valley of the Var. Its abrupt turn from a southerly to an easterly course he finds is due to the capture by the latter of the former section of the river, originally draining to the west. Subsequent chapters are devoted to a discussion of the terraces of the Var followed by a description of the present valley system. The final chapter treats of the deforestation of the area, begun on a large scale in the sixteenth century but mainly practiced during the lawless period of the French Revolution. The result is only too evident in the bareness of the slopes and the washing away of the soil, conditions which the Service du Reboisement, instituted in 1882, finds difficult to remedy, as the Service is forced to purchase the desired territory piecemeal of its present owners, who are almost rendered destitute by thus being deprived of the pastures for their flocks on which they depend for their subsistence. W. L. G. J.

EDUCATIONAL GEOGRAPHY

Broad Lines in Science Teaching. Edited by F. Hodson, Ph.D., B.Sc., with an introduction by Prof. M. E. Sadler, M.A., LL.D. xiv and 267 pp. The Macmillan Co., New York, 1910. $1.25.

The book includes twenty-one chapters devoted to varied phases of science teaching. Among general problems considered are the following: The Place of Science in the School Curriculum, The Place of Hypotheses in Science Teaching, The Claims of Research Work and Examinations, Science Teaching and the Training of the Affections, Science Teaching and a Child's Philosophy. The special subjects considered are Nature Study, Biology, Hygiene, Mathematics, Physics, Geography, History, Economic Science, Domestic Science, Chemistry, Agriculture, Engineering and Physics.

The volume is a symposium of expert opinions and in consequence the ideals and principles proposed in the several chapters seem to lack a certain advisable unity of aim. In spite of this lack, which is felt sharply in certain chapters, the book is most suggestive, even to a specialist in one field. In general, the authors agree in advocating that science in schools should be closely related to daily life—a point of view that has been much discussed in America in recent years and which has been most effectively promoted by teachers of physics.

The special chapter on geography teaching is not particularly suggestive as it does not consider the larger problems of how to teach geography to children. It advocates an early emphasis of physiography in the English sense, followed by regional geography in which the physical features receive proper attention in a causal order. As a field of work for secondary pupils, this phase of geography teaching has been much neglected in American schools and is just beginning to receive some attention. The chapter in question, however, adds little that will help in a better formulation of real geography in secondary schools, and is too general in tone to be really constructive. R. E. Dodge.

MATHEMATICAL GEOGRAPHY AND CARTOGRAPHY

Höhenschichtenkarten. Studien und Kritiken zur Lösung des Flugkartenproblems. Von Dr. Karl Peucker. Sonderabdruck aus der *Zeitschrift für Vermessungswesen*. Jahrgang 1910. 59 pp., 4 figures and 1 colored plate. Konrad Wittwer, Stuttgart.

This paper, which is nominally intended to offer a contribution to the problem of maps for aëronauts, is far more comprehensive than its sub-title implies. After detailed critical review (pp. 3-32) of previous methods of representing relief on maps by gradational color schemes the author presents a summary of the system he first developed in his treatise on "Schattenplastik und Farbenplastik," Vienna, 1898, which is based on a rational adaptation of the color sequence of the spectrum. The present paper is accompanied by a highly suggestive map showing the application of the author's method to a section of the Austrian map of Central Europe, 1:200,000, which he himself characterizes as the first complete application of his principles. The solution he offers of the general problem of plastically representing relief he also believes to be the right one in the preparation of maps for aëronauts.

Whatever subsidiary criticisms of Peucker's method may be, his lasting contribution to cartography is that he has supplanted subjective and arbitrary methods by a rational and scientific principle. W. L. G. J.

PHYSICAL GEOGRAPHY

Meteorology Practical and Applied. By Sir John Moore. Second revised and enlarged edition. xxvii and 492 pp., III pls., 98 figs. Rebman Limited, London, 1910.

It is a good sign when a book on meteorology, like that of Sir John Moore, goes into a second edition. The volume is not adapted for use as a text-book in teaching, hence its sale must be practically altogether among the great body of "general readers" who have an interest in weather, and are anxious to know something about its controls. Sixteen years have elapsed since the publication of the first edition, and, as was to be expected, the new book is both "revised and enlarged." *Meteorology Practical and Applied* is clearly the work of a practicing physician who has many interruptions in the pursuit of his "hobby," if the latter term can really be applied properly to a subject which is as closely related to a man's profession as meteorology is related to medicine. Sir John Moore's book is evidently the outgrowth of the author's keen interest in meteorological conditions, and in the relation of these conditions to health and disease. He has read over a fairly wide range of subjects, but almost altogether in English, and his chief source of information has been the *Quarterly Journal* of the Royal Meteorological Society. Excellent as that journal is—and its usefulness is steadily increasing—one would hardly wish to be dependent upon it as the sole, or even the chief, authority for the progress of meteorology. It is along this line that meteorologists will probably feel most disposed to criticize Sir John Moore's book.

We have said that the book is not well adapted for use in teaching, being rather loosely put together, and very uneven in its treatment of important subjects. It differs from most text-books on meteorology in the amount of space which is devoted to Climate (there are two chapters on climate, and two on the climate of the British Isles), yet it cannot be said that even these chapters are

satisfactory. The author's medical interests are clearly reflected in his discussion (Part IV) of "The Influence of Season and of Weather on Disease," in which many facts are brought together, chiefly scattering British observations.

It is, of course, rather unfair to criticize too harshly a book by an author who does not pretend to be a meteorologist. Yet a volume on meteorology is, after all, a volume on meteorology, and as such must be subjected to favorable or unfavorable comment. Our author, it should be said, protects himself in his opening statement, that "the writing of this book has been to me a labour of love," yet in the second paragraph of his preface he adds that "the physician of all men has the fullest opportunities of observing the far-reaching influence of weather and climate upon human health, happiness and longevity." It is unfortunate that Hadley's explanation of the deflective effect of the earth's rotation (pp. 4-5) should be given as if it were complete and accurate; that (p. 5) the expression "these winds must make for that centre so as to fill up its vacuum" should be used (a similar reference is made to a vacuum on p. 157); that there should be so inadequate an explanation of the diurnal variation of the barometer, without any reference to the important researches of Hann, Margules and others; that there should be so very superficial a treatment of cyclones and anticyclones, with practically no mention of the general circulation of the atmosphere, although the trades are mentioned, and, we regret to say, the "antitrades," meaning the westerlies.

In many respects the book is up to date, as in the new chapter on the upper air. It is, however, behind the times in the matter of forest meteorological observations, although, we are very glad to say, ahead of the times in referring to Professor C. F. Marvin, of the U. S. Weather Bureau, as "the late Professor Marvin." On page 260 Prof. F. W. Very is referred to as Prof. F. W. Verz. The book is particularly strong in its descriptions of instruments, a large number of which, it may be said, are practically, or wholly, unknown in this country.

R. DEC. WARD.

GENERAL

Statistique Annuelle de Géographie Comparée. Par Jean Birot, Agrégé de l'Université, Professeur au Lycée Carnot. 6me Année 1910. Hachette et Cie., Paris. 32 pp.

An invaluable little publication (Cf. *Bull.* Vol. 40, p. 179). Based on the official statistical publications of the various countries, the leading statistical journals and such publications as the Statesman's Year Book and the Almanach de Gotha, this pamphlet of 32 pp. contains a compact summary of the world's statistics of value to the geographer. Its contents are divided as follows:

[I] Population: (a) of the world, (b) by countries; [II] Agriculture and Industries: (A) Foods, classified as of mineral (i. e. salt), vegetable and animal origin, (B) Textiles, of vegetable and of animal origin, (C) Fuels, (D) Minerals; [III] Commerce: (A) Transportation: (1) Navigation, (2) Railroads, (B) Postal and Telegraph Service, Telephones, (C) Value of Commercial Transactions (export and import), [IV] Finances; Army and Navy. In each subdivision of section II and in section III A, additional statistics are given for France, but otherwise the information is well co-ordinated. In sections I, II and IV enumeration is necessarily by countries, in section II by products, classified according to the country of their origin. Section Ib gives the population of each country, its density, the population of its major subdivisions and of its larger cities. Section III A 1 gives the tonnage cleared at the principal

ports of the world. Section III A 2 gives statistics of the five Alpine tunnels, including the Lötschberg.

The value of this publication lies in the fact that it has been compiled from the geographer's point of view. It renders the statistics of interest to the geographer immediately available, and, therefore, within its limits does away with the necessity of consulting such compilations of original material as abstracts, yearbooks, etc., which contain a great deal of matter irrelevant to the geographer. W. L. G. J.

Geographen-Kalender. In Verbindung mit vielen Fachgenossen herausgegeben von Dr. Hermann Haack. Neunter Jahrgang 1911. Justus Perthes, Gotha. vi and 824 pp. 6 M.

The present edition of this indispensable book of reference for geographers contains the directory of geographers (pp. 281-693), which alternates with the list of geographic institutions published every other year. The only departure from previous usage is the omission of the maps from the present edition. Lack of time to revise the maps, which were mainly excerpts from Stieler's Handatlas, in conformity with the results of new explorations, together with the additional expense, are, according to the editor, responsible for their omission. The Kalendar is prefaced by a biography (pp. 2-35) of the Argentine geographer, Francesco P. Moreno, Gold Medalist of our Society, by Bailey Willis, in English and German. The latter version, which evinces a quite exceptional mastery of the language, is also from his pen, and is an instance of the relative insignificance to the man of broad mind of so small an obstacle as the acquisition of a foreign language. The remainder of the book is devoted to the usual departments: astronomical tables, (pp. 39-67), record of current events, (pp. 71-109), explorations, (pp. 113-143), geographic literature of 1910, (pp. 147-253), necrology, (pp. 257-275), advertisements (pp. 699-784) and table of contents and index, (pp. 789-819). W. L. G. J.

La Géographie Humaine. Essai de Classification. Positive principes et exemples. By Jean Brunhes. iv and 843 pp., illustrations and maps. Félix Alcan, Paris, 1910. Fr. 20.

Professor Brunhes's work makes no attempt to define human geography, but he makes it very clear that it consists of material facts, things visible and photographable. The spirit of geography indeed is to get one's eyes open and learn to see. As this is difficult, he gives abundant illustration in concrete examples of how one tries to see and what one looks for.

The work is in the main a collection of geographic monographs, worked out in the effort to show what a geographic study should consider. Though his publisher lists his work under History (!) Brunhes is careful to draw the line between geography and history. What men have recorded of the past may, he says, shed light on the present, but the geographer's main occupation is with the facts as he may see them to-day. He will hardly deal satisfactorily with them as a geographer unless he examines them himself in the open air where they occur.

The psychologic element that enters into geography is determining. The natural environment is pure geography, a pine forest for instance; but whether the visible human-geographic facts that result are wigwams and trails or furniture factories and railroads depends on the minds of the inhabitants. He seems to find such a work as Miss Semple's inclined to attribute overmuch, per-

haps, to geography and too little to the psychologic factor. Old time historians, on the other hand, were too ready to form superficial conclusions. "History is wrought out on the earth, but it is made up of elements that are most complex, mixed and remote from elementary geographic considerations. The profound influence of geography on the evolution of human society is to be explained by intermediary facts, facts of the second order, tillage, pasturage, etc., and facts of the third order, facts of social geography" (p. 59). Michelet is therefore a horrible example. "One must begin at the beginning with less ambitious and more modest labors."

He classifies the human-geographic material, that must be patiently examined into three groups—six types—of "essential facts." The first are facts of unproductive occupation of the soil. Houses and roads are the items in mind, and for the first, at least, its intimate geographic character is admirably shown in the monographs which make up the body of the work. The author is careful to point out that his work is not a treatise. Any American could at once supplement his account of wooden houses, as the author knows them in north Europe; anyone who has seen the Norwegians building their highly refined log houses, that suggest when finished the American frame dwelling to which they have no structural likeness, could amplify the account there. But Brunhes does give an admirable geographic account of the wooden house and its shingles in the forests of the north, its replacement by buildings of earth and brick on the treeless steppes and its substitution by brick and stone when destroyed by the constant enemy, fire—geographic, since the environment offered an invitation that man accepted. So in the Mediterranean realm a new landscape of rocky ridges is accompanied by a new house-type. From the house comes the village and the city. Types are described from the regions of the author's personal knowledge, roughly the extent of the old Roman Empire. It is not, therefore, the geography of the house, but what influence geography has had on house building in Germany, Switzerland, Italy, Spain, Algeria, Egypt and Syria. These bits are admirable. The author has illustrated them with photographs of his own taking with detailed legends, showing wherein they illustrate.

The second group of essential facts is "facts of vegetable and animal conquest," which means domestication. For the plants, especially, this plunges us at once into a study of the suitable environment. With Köppen's climate work as a basis, he proposes a new division of world-zones; he has already declared that the two fundamental maps for human geography are those of rainfall and distribution of people. Now he divides the earth into five contrasted zones: boreal forests, equatoreal forests, hot-and-cold deserts, always-cold deserts and steppes. Between these lie transition zones and there lives man (p. 316). The transitions are not merely of temperature but also of humidity. Perhaps the best passages in this geography of cultivated plants is the outline of an account of cotton culture in a later chapter on things pedagogical, an ideal method of presenting a topic in commercial geography (p. 721).

It would be interesting to know the evidence that the potato, maize and tobacco have been cultivated for 2,000 years. Fortunately the author does not hold closely to his scheme of classification. His book is a mine of interesting bits told "en passant." A table shows wheat harvests somewhere on the globe in every month of the year. Sheep, demanding wide space for economic raising, diminish in numbers in new countries as the population grows (p. 375). Nomadism is well established as geographic, since it depends on a certain environ-

ment, not on a stage in history, yet the psychologic factor appears (p. 394). In nomadic Algeria horses are less and less bred. Formerly the horse was a valuable aid in pillaging. But the stable French government has made pillage unprofitable, so the horse is not bred. So of old the nomads invaded the sown land every season of drought, and produced a border of unsafe, neglected plowland near the desert. Under good government this is occupied by agriculture and nomadism appears to be on the wane. Too hasty conclusion might suggest that the climate is becoming moister. Conversely, the overthrow of good government allows nomadism to drive back agriculture, producing the appearance of more arid climate. This is of course of interest in connection with Dr. Huntington's studies of climate fluctuations in the East, which Brunhes seems not to know. He warns against the neglect of the psychologic factor at every turn. The essays on the Fang in the French Congo, the inhabitants of the Algerian oases, the Souf and M'zab, and the perpetual migration of the people of the valley of d'Anniviers in Valais well repay reading.

A third group of essential facts is "facts of destructive economy," man's exhaustion of forests, animal species and mineral deposits. This leads to an interesting account of the human geography of coal.

Professor Brunhes's work is rich in geographical material. His geography is not a science of relations but a subject of study and a most interesting one. The earth is its topic and only when the adjective human is added does man come into the story.

MARK JEFFERSON.

Nautical Science in its Relation to Practical Navigation, together with a Study of the Tides and Tidal Currents. By Charles Lane Poor. xi and 329 pp., illustrations and index. G. P. Putnam's Sons, New York and London, 1910.

The work falls into three rather disconnected parts. The first of these gives an elementary account of the earth and the solar system apparently for "rule of thumb" navigators, who may be familiar with some processes but few principles of navigation. The sketch is not limited to things bearing on navigation but is very slight and in very simple language. In the account of Foucault's pendulum the explanation is the familiar but unsatisfactory reference to the "lagging" of a south-bound body behind the faster moving earth of the southern end of its swing and "running ahead" on going north. If Prof. Poor should swing his pendulum east and west it would still "deviate" to the right, as he is aware, though performing its whole swing in the same latitude. Another third of the book deals with matters of navigation, finding time, latitude and longitude at sea. The history of Sumner lines and the account of their importance is good. The attempt to dispense with mathematics rather collapses when several forms of the equation for solution of hour angle are introduced. Here they are quite out of place. A trigonometry or a spherical astronomy would develop them and transform them, and, after all, what can be simpler than that? Is not a good mathematical treatise the simplest possible means of getting at mathematical results and understanding them?

Last comes an excellent account of tides as local oscillations of the ocean, and of tide-predicting machines. Dr. Harris's part in the discovery of the local character of tides is overemphasized. As the present reviewer noted in the *National Geographic Magazine* just before Dr. Harris's papers were published, the oscillation of the Atlantic was detected nearly a century ago by Young and Whewell and Fitzroy. As to the cause of the tide our author makes a good

point when he emphasizes the importance of horizontal forces as compared with vertical ones in efficiency for raising tides, but has lost an important advance in popular statement when he failed to utilize the Davis-Darwin doctrine of centrifugal force partly balancing the moon's attraction. Still the 80 pages on tides are clear and fairly new. MARK JEFFERSON.

NEW MAPS

NORTH AMERICA

U. S. COAST AND GEODETIC SURVEY MAPS

ALASKA. Sketch of General Progress, U. S. Coast and Geodetic Survey, June 30, 1910. 1:5,000,000 (78.90 miles to an inch). Black. Accompanies Report of Supt., C. and G. S., 1909-10. [Symbols for gravity stations, latitude, longitude and azimuth determinations, tidal and magnetic observations, areas covered by triangulation, topographic and hydrographic surveys, lines of deep-sea soundings.]

HAWAIIAN ISLANDS. General Progress Sketch, U. S. Coast and Geodetic Survey, June 39, 1910. (1:2,000,000 approx. [31.56 miles to an inch].) Black. On part of plate including Porto Rico. Accompanies Report of Supt., C. and G. S., 1909-10. [Hawaiian Government Surveys included; indicates areas covered by triangulation, topographic and hydrographic surveys, lines of deep-sea soundings, and stations of which longitudes have been determined by telegraph.]

PHILIPPINE ISLANDS. Sketch of General Progress, U. S. Coast and Geodetic Survey, June 30, 1910. Mercator Projection, 1:5,000,000 in lat. 13° N. Black. Accompanies Report of Supt., C. and G. S., 1909-10. [Same symbols as on corresponding map listed under Alaska.]

PORTO RICO. General Progress Sketch, U. S. Coast and Geodetic Survey (June 30, 1910). (1:675,000 approx. [10.26 miles to an inch].) Black. On part of plate including Hawaiian Islands. Accompanies Report of Supt., C. and G. S., 1909-10. [Shows areas covered by primary and secondary triangulation and by topographic and hydrographic surveys.]

UNITED STATES. Sketch of General Progress, U. S. Coast and Geodetic Survey, June 30, 1910. 1:5,000,000 (78.90 miles to an inch). Two sheets. Black. Accompanies Report of Supt., C. and G. S., 1909-1910. [The current edition of this map, which is revised to date every year. It indicates areas covered by primary, secondary and reconnaissance triangulation and by topographic and hydrographic surveys, and shows lines along which deep-sea soundings have been taken and geodetic leveling has been done.]

UNITED STATES. Four base maps of the United States, 1:7,000,000 (110.46 miles to an inch) showing, in red: (1) Distribution of the Principal Astronomic Stations Occupied by the U. S. Coast and Geodetic Survey for Latitude, Longitude and Azimuth to June 30, 1910; (2) Positions and Connections of Telegraphic Longitude Stations from 1846 to June 30, 1910; (3) Routes of Geodetic Spirit Leveling and Positions of Gravity and Tide Stations to June, 1910; (4) Positions of Magnetic Stations Occupied to June 30, 1910. Accompany Report of Supt., U. S. Coast and Geodetic Survey, 1909-10.

U. S. HYDROGRAPHIC OFFICE CHARTS

Pilot Chart of the North Atlantic Ocean, May, 1911. On reverse: Method for Determining the Position of a Vessel in Sight of a Fixed Point, by Capt. N. Marcantetti.

Pilot Chart of South Atlantic Ocean, June, July, August, 1911.

Pilot Chart of South Pacific Ocean, June, July, August, 1911.

Pilot Chart of the North Pacific Ocean, July, 1911.

PORTO RICO. (Maps of Porto Rico, 1:1,000,000 approx. [15.78 miles to an inch] showing): I. Mean Annual Temperature and Prevailing Direction of the

Winds; II. Average Annual Extremes of Temperature; III. Average Annual Rainfall (five degrees of density). Accompany "The Climate of Porto Rico" by O. L. Fassig. Reprinted from "The Register of Porto Rico for 1910."

SOUTH AMERICA

ARGENTINA. Croquis-Itinerario desde Rosario de Lerma hasta Cachi, construído por Franz Kühn. 1:133,300 approx. (Region near 25° S. and 66° W.) Accompanies paper with similar title by the same author, *Bolet. del Inst. Geogr. Argentino,* Vol. 24, facing p. 50. With inset map "Bosquejo esquematico de orientacion." Relief in sketch contours.

AFRICA

BELGIAN CONGO. Carte du District du Katanga, Congo Belge, dressée par H. Droogmans, Sécrétaire Général du Ministère des Colonies. 1:1,000,000 (4° 30′-14° 0′ S.; 23° 40′-31° 45′ E.). 2 sheets. Black. April, 1910. [A fundamental general map incorporating all that is known of the region it represents. In spite of its execution in one color it is entirely legible. Relief is broadly indicated by hachures. The routes of the Mission Scientifique du Katanga (Capt. Lemaire) and of the chief explorers of the region are shown. Mineral deposits are indicated, distinction being made between deposits of tin, iron, copper and precious metals.]

BELGIAN CONGO. Carte du Bas Congo dressée par H. Droogmans, Sécrétaire Général du Ministère des Colonies. 1:100,000 (4° 10′-6° 3′ S.; 12° 13′-15° 27′ E.). 15 sheets. Black. Edition of April, 1910. [A new edition of this fundamental detailed map of the "panhandle" of the Belgian Congo lying W. of the meridian of Stanley Pool. The possibility of compiling so detailed a map of this region, of which a previous edition appeared in 1902, is due to its being traversed by the Leopoldville-Matadi Railroad circumventing the rapids of the Lower Congo. A rectangular co-ordinate system, of which 20° E. and the equator are the ordinate and the abscissa, forms the basis of this map. Sheet 15 contains an inset map of Stanley Pool.]

BELGIAN CONGO. Carte du Bas-Congo. 1:1,000,000. 2e Édition. Tableau d'Assemblage de 15 feuilles au 100,000e dressées par H. Droogmans, Sécrétaire Général du Ministère des Colonies. (4° 0′-6° 10′ S.; 12° 0′-15° 40′ E.). Black. April, 1910. [Index map of the 15 sheet map of the lower Congo, 1:100,000.]

BELGIAN CONGO. (1) Map showing Mining Localities and Approximate Geological Boundaries in Belgian Congo. (2) Map of the Belgian Congo Showing Railroads and Mining Concessions. (Both maps in 1:23,500,000 approx. [370 miles to an inch]). Accompany paper read at Pittsburg, March 1910, on "Mining Conditions in the Belgian Congo" by S. H. Ball and M. K. Shaler, *Trans. Amer. Inst. Mining Eng.,* Vol. ?, p. 254. [Map 1 distinguishes between (1) lavas, (2) flat sandstone and shale of central basin and sedimentary rocks of coast, (3) granite and other igneous rocks, (4) folded sedimentary rocks and schists. Map 2 shows the boundary of the areas allotted to the various exploiting companies.]

BRITISH EAST AFRICA. Map of Africa, 1:125,000 (1.97 miles to an inch). Geographical Section, General Staff. Sheets South-A-37/V-II, 1910 (East Africa Protectorate: Mangea: 3° 0′-3° 30′ S.; 39° 30′-40° 0′ E.) and South-A-37/V-IV, 1911 (East Africa Protectorate: Takaungu: 3° 30′-4° 0′ S.; 39° 30′-40° 0′ E.). Surveyed under the direction of the Director of Surveys, East Africa Protectorate. Drawn and printed at the War Office, and photo-etched at the Ordnance Survey Office, Southampton. 5 colors, relief in contours ("form lines"), interval approximately 100 ft. Price 2/- a sheet. [The above two sheets represent a part of the coastal belt between Malindi and Mombasa. The great number of features delineated is quite exceptional in a map of so sparsely settled a country, the legend containing no less than 56 distinct symbols. Relief is in brown, drainage in blue, vegetation in green, culture in black and red. The representation of vegetation (separate symbols for forest, cocoanut palms, and bush and scrub) is a particularly welcome feature that might be

introduced to great advantage upon our otherwise so admirable topographic sheets. The execution of the map is excellent.]

THE CAPE OF GOOD HOPE. Geological Map of the Province of the Cape of Good Hope published by the Geological Commission. 1:238,000, or 3.75 miles = 1 inch. Sheet 11 (Clanwilliam: 31° 40′-32° 40′ S.; 18° 0′-20° 0′ E.) Geology by A. W. Rogers, E. H. L. Schwarz, A. L. Du Toit (described in Annual Reports of Geol. Comm. for 1900, 1903, 1904). 12 colors. Sheet 13 (Beaufort West-Fraserburg: 31° 40′-32° 40′ S.; 21° 20′-22° 40′ E.) Geology by A. W. Rogers and E. H. L. Schwartz (described in Annual Reports of the Geol. Comm. for 1896, 1900, 1902, 1910). 2 colors. [No representation of relief. Sheet 11 distinguishes between Superficial Deposits, Karroo System (3 series), Cape System (3 series), Ibiquas Series, Malmesbury Series, Intrusive Rocks; sheet 13 between sedimentary and intrusive rocks of Karroo System. The latter sheet includes part of the Nieuweveld Escarpment.]

CENTRAL AFRICA. (Map showing) Dr. Karl Krumm's Route (from S. Nigeria to Khartum) (1:22,500,000 [359 miles to an inch] 20° N.-0°; 5°-40° E.) *Scott. Geogr. Journ.*, Vol. 27 (1911,), p. 226. [Also shows the routes of Capt. Boyd Alexander, 1904-07, and of Nachtigal, 1869-74.]

MOROCCO. Zône de 10 Kmètres Autour de Tétouan. 1:100,000. *Renseign. Col.*, 1911, No. 4, facing p. 90. [Relief in sketch contours.]

UPPER GUINEA. Carte Démographique de l'Afrique Occidentale Française. (1:13,750,000 approx. [about 215 miles to an inch] 20°-4° N.; 21° W.-9° E. of Paris.) *L'Afrique Franç.*, Vol. 21 (1911), p. 127. [Distinguishes between seven grades of density of population, using the administrative divisions of the "cercles" as units.]

ASIA

DUTCH EAST INDIES. (Map of the Island of Ambon and adjoining islands of the Moluccas) 1:250,000. Accompanies *Bijdr. tot de Taal-, Land- en Volkenkunde van Nederlansch-Indië*, Deel 85, 1911, facing p. 337. [Gives bare outlines only; possibilities of so large a scale not utilized.]

DUTCH NEW GUINEA. Map to illustrate the expeditions of H. A. Lorentz, LL.D., in Dutch New Guinea, 1907-1909. 1:400,000, or 1 inch = 6.31 statute miles. (4° 12′-5° 0′ S.; 138° 30′-139° 0′ E.) *Geogr. Journ.*, Vol. 37 (1911), No. 5. With inset map 1:8,000,000, showing area of detailed map. 4 colors. [Relief in brown shading, drainage in blue, routes in red.]

INDIA. Volksdichte in der Oberen Gangesebene, auf Grund des "Census of India" vom Jahre 1901 entworfen und gezeichnet von Paul Böllert. 1:2,500,000 (39.46 miles to an inch.) *Pet. Mitt.*, I. Halbband, 4. Heft, Taf. 33. (30°-25 N.; 77°-87° E.) [Shows the limit of the Gangetic Plain and distinguishes between six grades of density of population, three above and three below the mean, using three tints of the same color to designate the two categories, respectively.]

MANCHURIA. Pestkarte der Mandschurei. Entworfen von Dr. Rudolf Pöch. 1:5,000,000 (78.91 miles to an inch). (55°-34° N.; 104°-140° E.) *Pet. Mitt.*, I. Halbband, 4. Heft, Taf. 35. [Shows centers, distribution and lines of advance of the recent and of former plague epidemics in Manchuria.]

PHILIPPINE ISLANDS. (a). Map Showing Relation of Recent Vulcanism to Principal Tectonic Lines; (b) (Geologic Map of Philippine Islands); (c) Map of Philippine Is. Showing Principal Mineral Districts and Distribution of Known Coal Fields. 1:10,000,000 approx. (157.83 miles to an inch). Black. Plates II, III, and V of "The Essential Features of the Geology of the Philippine Islands" by W. D. Smith, *Philipp. Journ. Science*, Section A, Vol. V, pp. 307-342, Manila, 1910. [Map b distinguishes between Alluvial areas, Tuff and conglomerates, Tertiary sedimentaries, Extrusive rocks, Complex of igneous and metamorphic rocks, Metamorphic rocks; Map c shows gold, copper, iron and coal districts.]

PHILIPPINE ISLANDS. Sulu Island. Based on Military Maps of Department of Mindanao 1901-1902 and the Observations of Dr. N. M. Saleeby. About 6

miles to an inch (1:380,000 approx.) Black. Plate II of "Geologic Reconnaissance of Mindanao and Sulu: II. "Physiography" by W. D. Smith. *Philipp. Journ. Science,* Section A, Vol. V, pp. 345-362, Manila, 1910.

AUSTRALASIA AND OCEANIA

WESTERN AUSTRALIA. Geological Sketch Map of Western Australia by H. P. Woodward, Asst. Gov't. Geologist. Scale, 100 miles = 1 inch. (1:6,336,000). Black. Accompanies "The Geology and Ore Deposits of the West Pilbara Goldfield" by the same author, Bull. 41, Geol. Surv. of W. Austral., Perth, 1911. [Valuable general geologic map of Australia west of 129° E. Distinguishes between (1) Recent and Tertiary, (2) Mesozoic, (3) Paleozoic, (4) Metamorphic (a) sediments, (b) greenstones, and (5) Granite and Gneiss. It also shows the "rabbit-proof fence" extending entirely across the continent in a meridional direction from near the mouth of the DeGrey River on the north coast to the south coast in 121° E.]

WESTERN AUSTRALIA. Geological Sketch Map of the West Pilbara Goldfield by H. P. Woodward, Asst. Govt. Geologist. Scale, 6 miles = 1 inch (1:380,160). (20° 10′-21° 50′ S.; 116° 5′-118° 40′ E.) Accompanies paper with analogous title by the same author. Plate I of Bull. 41, Geol. Surv. of W. Austral., Perth, 1911. [Distinguishes between (1) Alluvium, (2) Lavas, Sandstones and Conglomerates (Nullagine Series), (3) Granite, (4) Schists and Slates, (5) Dolerites, Gabbros, Serpentines, and indicates gabbro dykes and banded cherts. Knowledge of the chronologic sequence of formations of this district too scant to allow of classification on a formational basis.]

WESTERN PACIFIC OCEAN. Approximate Tracks of the Typhoons and Depressions (in the Western Pacific Ocean) of September, 1910. Mercator Projection, equatorial scale 1:18,000,000 approx. (38°-7° N.; 100°-150° E.). Accompanies *Bulletin* for Sept. 1910, Weather Bureau, Manila Central Observatory, Manila, P. I., 1911.

EUROPE

AUSTRIA-HUNGARY. (Geological Map of the Environs of the Spa of Stubičke Toplice, Croatia) 1:10,000 (0.15 mile to an inch). 4 colors. Accompanies paper on similar subject by Dr. Gorjanović-Kramberger, Baron C. Steeb and M. Melkus as Tafel I of *Jahrb. der k.k. Geol. Reichsanstalt,* Vol. 60 (1910), Heft 1, Vienna, 1910.

AUSTRIA-HUNGARY. (Geological Map of the Vostry Fault Region, Central Bohemia.) 1:25,000 (0.39 mile to an inch). 10 colors. Accompanies paper on same subject by Dr. A. Liebus as Tafel V of *Jahrb. der k.k. Geol. Reichsanstalt,* Vol. 60, (1910), Heft 1, Vienna, 1910.

GENERAL

WORLD. Kautschuk-Weltkarte 1911. Mercator Projection, equatorial scale, 1:70,000,000 approx. Accompanies *Beiheft zum Tropenpflanzer,* Vol. 15, Nr. 5, May, 1911. Berlin. [Delineates four degrees of intensity in the productiveness of the rubber districts of the world and indicates by symbol nine different species of plants from which caoutchouc is derived, distinguishing between wild and cultivated species.]

WORLD. Erdkarte der Ausbreitung der Pest am Ende des 19. und am Anfang des 20. Jahrhunderts. Entworfen von Dr. Rudolf Pöch. (Mercator Projection. equatorial scale, 1:80,000,000.) *Pet. Mitt.* I. Halbband, 4. Heft, Taf. 34. [Shows ancient endemic plague centers, present distribution of epidemic plagues, occurrences of plague with their date, principal routes of navigation serving to transmit the plague.]

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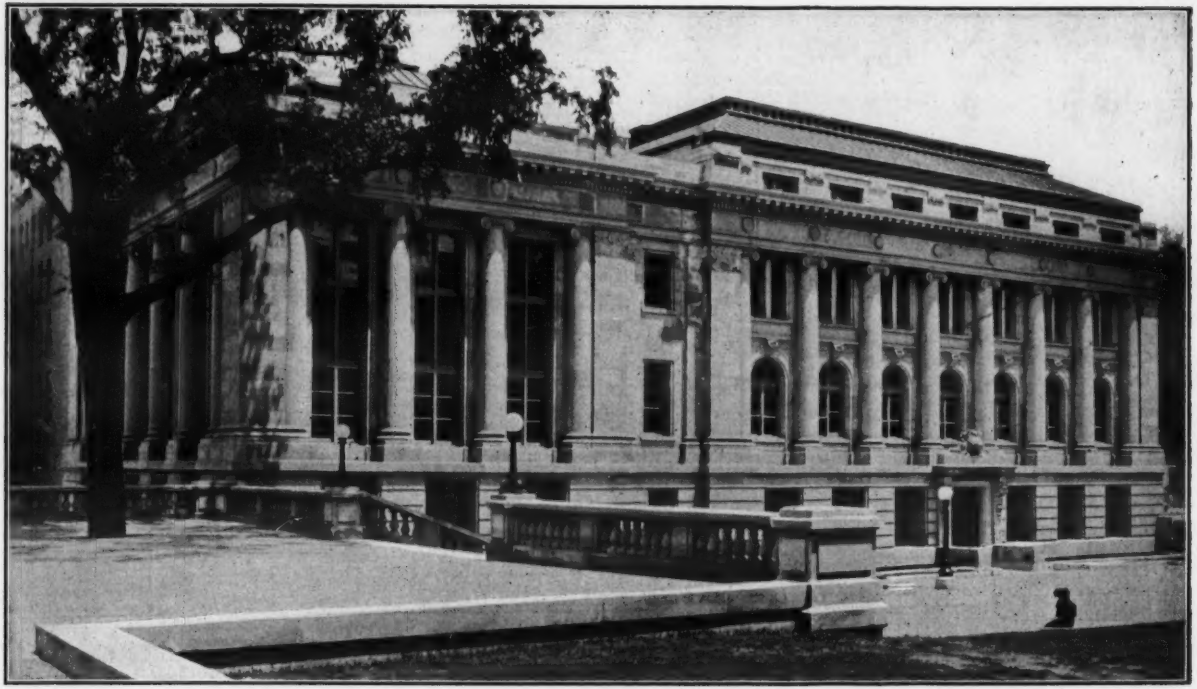

SOUTH FRONT OF THE AMERICAN GEOGRAPHICAL SOCIETY'S BUILDING.

Shows the main entrance and the relation between the main building and the stack house containing the library.